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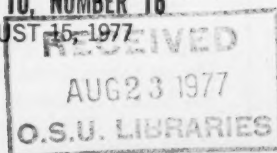


SELECTED
≡ **WATER**
RESOURCES
ABSTRACTS

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VOLUME 10, NUMBER 16
AUGUST 15, 1977



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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,
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VOLUME 10, NUMBER 16
AUGUST 15, 1977

W77-07601 -- W77-08100

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ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

SELECTED WATER RESOURCES

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.



U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

WATER RESOURCES DIVISION

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FOREWORD

Selecting Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

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09 MANPOWER, GRANTS, AND FACILITIES

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10 SCIENTIFIC AND TECHNICAL INFORMATION

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

HYDROLOGIC OPTICS. VOLUME I. INTRODUCTION.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
R. W. Preisendorfer.
1976, 251 p.

Descriptors: *Optical properties, *Light intensity, *Water properties, *Physical properties, Hydrologic properties, Light quality, Photometry, Food chains, Model studies, Light penetration, Numerical analysis.
Identifiers: *Hydrologic optics, *Radiometry, *Underwater visibility.

The first chapter in Volume I in a series of six volumes may serve as a self-contained 'short course' on hydrologic optics. Particular attention is directed toward the three simple models for light fields in natural waters. These models constitute the minimal theoretical tools for the field of hydrologic optics. Attention is also directed to the section dealing with practical nomographs for predicting the range of visibility available to underwater swimmers in various natural hydrosols such as harbors, lakes and seas. Also of general interest are the many samples of magnitudes of light fields and optical constants found in natural waters. Chapter 2 is concerned with the scientific language of radiative transfer: geometrical radiometry and provides the radiometric concepts and formulations needed in the applications of the interaction principle to hydrologic optics. (See also W77-07957 thru W77-07961) (NOAA)
W77-07956

HYDROLOGIC OPTICS, VOLUME II. FOUNDATIONS.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
R. W. Preisendorfer.
1976, 410 p.

Descriptors: *Optical properties, *Light, *Reflectance, *Water properties, *Physical properties, Radiation, Irradiation, *Hydrologic properties, Numerical analysis.
Identifiers: *Hydrologic optics, Photoelectric effects, Irradiance, Scalar irradiance, *Transmittance, Radiometry, *Radiant flux.

This second volume of a set of six volumes of the text on hydrologic optics deals with foundations: radiometric and photometric concepts and the interaction principle. Detailed treatment is given on: radiant flux; the meaning and fundamental geometric properties of radiant flux; irradiance and radiant emittance; radiance; an invariance property of radiance; scalar irradiance, radiant energy, and related concepts; vector irradiance; radiant intensity; polarized radiance; transition from radiometry to photometry; generalized photometries; the interaction principle; reflectance and transmittance operators for surfaces; applications to plane surfaces; applications to curved surfaces; reflectance and transmittance operators for plane-parallel media; applications to plane-parallel media; interaction operators for general spaces; applications to general spaces; derivation of the beam transmittance function; derivation of the volume attenuation function; derivation of path radiance and path function; derivation of apparent-radiance equation; derivation of volume scattering function; equation of transfer for radiance; integral structure of the interaction operators and summary of the interaction method. (See also W77-07956) (NOAA)
W77-07957

HYDROLOGIC OPTICS. VOLUME III. SOLUTIONS.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
R. W. Preisendorfer.
1976, 253 p.

Descriptors: *Light, *Water properties, *Physical properties, *Optical properties, *Equations, *Diffusion, Aquatic environment, *Radiation, *Energy transfer, Aqueous solutions, Numerical analysis.
Identifiers: *Hydrologic optics, Light fields, *Radiance, Polarized radiance, Radiometry, *Equation of transfer, Radiant energy fields, Spherical harmonics, *Radiant energy.

This third volume of a set of six volumes of the text on hydrologic optics deals with the theory of light fields and solutions of the equation of transfer. Detailed treatment is given on the subjects of: radiance in transparent media; radiance in absorbing media; Koschmieder's equation for radiance; the classical canonical equation; the general canonical equation for radiance; canonical representation of polarized radiance; abstract versions of canonical equations; the n-ary radiometric concepts; equation of transfer for n-ary radiance, diffuse radiance, and path function; canonical equations for n-ary radiance; the natural solution for radiance; truncated natural solutions for radiance; optical ringing problem; transport equation for residual, directly observable, and n-ary radiant energy; solutions for the n-ary radiant energy equations; properties of time depended n-ary radiant energy fields; dimensionless forms of n-ary radiant energy fields; global approximations of general radiance fields; light storage phenomena; bases of the spherical harmonic method; abstract spherical harmonic method; classical spherical harmonic method; three approaches to diffusion theory and solutions of the classical and exact diffusion equations. (See also W77-07956) (NOAA)
W77-07958

HYDROLOGIC OPTICS. VOLUME IV. IMBEDDINGS.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
R. W. Preisendorfer.
1976, 215 p.

Descriptors: Optical properties, *Light, *Water properties, *Physical properties, Numerical analysis, Equations, Hydrologic properties.
Identifiers: *Hydrologic optics, *Invariant imbedding, *Imbeddings, Light fields, Differential equations, Optical media, Integral transform techniques.

The 4th volume of a set of six volumes of the text on hydrologic optics provides detailed treatment on invariant imbedding techniques for light fields. Subjects presented are: differential equations governing the steady state R and T operators; differential equations governing the time dependent R and T operators; algebraic and analytic properties of the R and T operators; algebraic properties of the invariant imbedding operators; analytic properties of the invariant imbedding operators; special solution procedures for R(a,b) and T(a,b) in plane-parallel media; method of modules for deep homogeneous media; method of semigroups for deep homogeneous media; method of groups for deep homogeneous media; homogeneity, isotropy and related properties of optical media; functional relations for media with internal sources; and invariant imbedding and integral transform techniques. (See also W77-07956) (NOAA)
W77-07959

HYDROLOGIC OPTICS. VOLUME V. PROPERTIES.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
R. W. Preisendorfer.
1976, 305 p.

Descriptors: *Light, *Physical properties, *Water properties, *Optical properties, Aquatic environment, Diffusion, Sea water, Equations, Stratification, Hydrologic properties, *Irradiation, Properties, Equations.
Identifiers: *Hydrologic optics, *Light fields, Radiance, Polarized radiance, Radiometry, Equation of transfer, Radiant energy fields, *Irradiance fields, Radiative transport equation.

In the 5th volume in a set of six volumes of the text on hydrologic optics major emphasis is on the optical properties of the sea that govern the penetration of natural light into its depths. The stratified light field, so prevalent in oceanography and limnology is studied and the special and interesting behavior of the light field and its attendant apparent optical properties at both small and great depths in the sea are explored in detail. Subjects treated in this volume are: models for irradiance fields; general theory of optical properties; optical properties at extreme depths; and the universal radiative transport equation. (See also W77-07956) (NOAA)
W77-07960

HYDROLOGIC OPTICS. VOLUME VI. SURFACES.
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Pacific Marine Environmental Lab.
R. W. Preisendorfer.
1976, 401 p, 84 fig, 8 tab, 327 ref.

Descriptors: *Optical properties, *Air-water interfaces, *Surfaces, *Hydrologic properties.
Identifiers: *Radiance, *Hydrologic optics, Sky radiance, Contrast transmittance.

The central problem addressed in this volume is the prediction of the reflected radiance distribution from a random sea surface, and the transmitted radiance distribution entering the body of the sea below the random surface. The main results are presented in equations. These equations describe the predicted radiance in terms of the wind-generated statistical parameters of the sea radiance distribution. With possible future oceanographic and meteorologic applications of this theory in mind, the author appended a hierarchy of approximate versions of the exact theory ranging from the exact time-averaged radiance theory down to the simple model of contrast transmittance of a random sea surface. (See also W77-07956) (NOAA)
W77-07961

TEMPERATURE REGIME IN LAKE SUPERIOR AT SILVER BAY, MINNESOTA.
R. A. Ragotzke, and H. J. Niebauer.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part I, p. 144-418, 1975. 4 fig., 5 ref.

Descriptors: *Lake Superior, *Water temperature, *On-site data collections, *Minnesota, Thermal stratification, Mixing, Upwelling, Internal waves, Lakes, Great Lakes.
Identifiers: *Silver Bay(Minn), Thermistors.

A chain of thermistors was installed on the shoreward side of a deep trough parallel and close to the shore of Lake Superior about one kilometer off Silver Bay, Minnesota, where the depth of the lake exceeds 275 meters. Thermistors were located at nine depths: 4.5, 9, 15, 30, 46, 61, 91, 122 and 152 meters. Electrical signals from the thermistors

Field 1—NATURE OF WATER

Group 1A—Properties

were transmitted by cable to a laboratory on the shore, where they were recorded at 2 1/2-minute intervals on an analog strip chart recorder and digitally on a magnetic disc. Data as recorded from July 2, 1971-April 9, 1973, with occasional breaks. Analysis of the data shows that Lake Superior undergoes both summer and winter thermal stratification and mixes vertically twice each year. Summer stratification does not start to develop until late July. The temperature cycle lags the solar radiation cycle by about three months. The maximum surface temperature, 12-14°C, and maximum thermal stratification of the Minnesota coast occur in September and minimum temperature, 0°C from the surface to 91 meters, occurs in April. Episodes of upwelling are clearly evident from the thermal record during both summer and winter stratification. Internal waves with the inertial and seiche periods for Lake Superior occur frequently and may extend to a depth of 91 meters. (Harris-Wisconsin) W77-07970

1B. Aqueous Solutions and Suspensions

HYDROLOGIC OPTICS. VOLUME III. SOLUTIONS,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07958

HYDROLOGIC OPTICS. VOLUME V. PROPERTIES,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07960

2. WATER CYCLE

THE REPRESENTATION OF A SHORT PERIOD OF EXPERIMENTAL CATCHMENT DATA BY A LINEAR STOCHASTIC DIFFERENCE EQUATION,
Institute of Hydrology, Wallingford (England).
R. T. Clarke.
In: *Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 3-15, 1974. 3 fig, 5 tab, 13 ref.*

Descriptors: *Mathematical models, *Demonstration watersheds, *Streamflow forecasting, *Synthetic hydrology, Stochastic processes, Analytical techniques, Runoff, Forecasting, Statistical models, Analysis, Hydrology, Foreign research, Statistical methods.
Identifiers: *United Kingdom.

Stochastic models for short-term hydrological forecasting have several drawbacks, but they also have one advantage: namely, that it is simple to give confidence limits for forecasts derived from them. Recently developed models based on stochastic difference equations have been widely used for forecasting in other fields, and one such model was identified and fitted to a short period of record (3 months) from a densely instrumented experimental catchment. This model gave 3-h-ahead forecasts with small errors, but more work is required before valid confidence limits can be stated for forecasts of longer range. The value of stochastic models is assured only if confidence statements for forecasts are useful, since conceptual models (whose parameters are more capable of physical interpretation) do not readily yield confidence limits for forecasts. It was suggested that a stochastic model also may play a role complemen-

tary to that of a conceptual model in that it can be fitted to the conceptual model's residuals, where these are shown to be non-random and, therefore, contain information which cannot be readily extracted by simply modifying the conceptual model. (See also W77-06708) (Humphreys-ISWS) W77-07646

2A. General

GENERATION OF MULTIVARIATE SYNTHETIC FLOWS,
Geological Survey, Reston, Va. Water Resources Div.
N. C. Matalas.
In: *Proceedings of a Workshop, Institute Di Idraulica and IBM, Pisa, Italy, p 27-37, December 1974. 6 tab.*

Descriptors: *Model studies, *Synthetic hydrology, *Streamflow, *Markov processes, Stochastic processes, Statistical models, Simulation analysis, Equations, Water resources development, Planning.
Identifiers: Operational hydrology.

Models for generating multi-site, single season synthetic flows are described. Because estimates of the value of parameters that characterize streamflow are biased and because historic flow sequences tend not to be concurrent and of equal length, problems are encountered in generating synthetic flows. To overcome these problems, the synthetic flow generators must be appropriately modified to assure statistical resemblance between the historic and synthetic flows. The nature of the modification is discussed. (Woodard-USGS) W77-07610

GLOSSARY OF WATER RESOURCE TERMS,
Open Lands Project, Chicago, Ill.
For primary bibliographic entry see Field 10C.
W77-07613

SOME APPLICATIONS OF STOCHASTIC FLOW GENERATION,
Birmingham Univ. (England).
M. J. Hamlin, and N. T. Kottogoda.
In: *Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 16-25, 1974. 6 fig, 3 tab, 11 ref.*

Descriptors: *Mathematical models, *Synthetic hydrology, *Streamflow, *Statistical models, Hydrological data, River flow, Stochastic processes, Markov processes, Watersheds(Basins), Statistical methods, Analytical techniques, Simulation analysis, Data processing, Foreign countries, Foreign research, Hydrology.
Identifiers: *United Kingdom.

This paper examined four linear data generating techniques which may be applied to British rivers. Extensions and modifications were considered, and the method which provides the best fit to the data was sought. The work included the statistical examination of the historical series and tests on the synthesized data. Initially, the month was chosen as an economical time unit for computer based methods. In order to meet further practical needs, time series were also formed using a five day unit. The marginal probability distributions of these series belong to a different population because of the increased skewness and additional parameters are required for definition. A study of the seasonal variation of serial correlation suggests that catchment persistence is nearly the same throughout the year. A method of smoothing the seasonal standard deviations of rivers with low summer flows was given. It was shown that synthesized data, formulated and tested by

statistical methods, can enhance the information found in the historical records. It is thought that in forecasting probable future behavior patterns in river flows, the application of logical data generation techniques should serve a useful purpose. However, with varying catchment and climatic characteristics and the possible shortcomings in the data, care is necessary in the choice of a model and the interpretation of the results. (See also W77-06708) (Humphreys-ISWS) W77-07647

STOCHASTIC ANALYSIS OF VELOCITY FLUCTUATIONS IN A NATURAL STREAM CHANNEL,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-07648

INVESTIGATIONS ON THE STRUCTURE OF FREQUENCY DISTRIBUTIONS OF FLOODS,
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 2E.
W77-07649

BAYESIAN ESTIMATION OF FREQUENCY OF HYDROLOGICAL EVENTS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W77-07650

STOCHASTIC STRUCTURE OF A PROCESS OF AVERAGE MONTHLY FLOWS,
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 2E.
W77-07651

METHODS FOR THE MATHEMATICAL DESCRIPTION OF THE STRUCTURE OF RIVER RUNOFF VARIATIONS,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 2E.
W77-07652

SPECTRAL ANALYSIS OF THE STRUCTURE OF HYDROLOGICAL SERIES,
For primary bibliographic entry see Field 2E.
W77-07653

SPATIAL AND TIME ANALYSIS AND ESTIMATION OF RIVER FLOW,
Moscow State Univ. (USSR). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W77-07654

ELEMENTS OF RUNOFF PERIODICITY IN TASKS OF MODELLING,
Gruzinskii Nauchno-Issledovatel'skii Institut Gidrotekhniki i Melioratsii, Tiflis (USSR).
For primary bibliographic entry see Field 2E.
W77-07655

CYCLICAL STRUCTURE OF THE HYDROLOGICAL SERIES AND THE NATURE OF INDIVIDUAL COMPONENTS,
Siberian Energy Inst., Irkutsk (USSR).
For primary bibliographic entry see Field 2E.
W77-07656

PROBLEMS ENCOUNTERED IN SYNTHETIC RIVER FLOW GENERATION PROCEDURES,
Water Resources Board, Reading (England).
R. J. G. Bloomer, and J. R. Sexton.
In: *Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July*

1971: International Association of Hydrological Sciences Publication No 100, p 91-100, 1974. 1 fig, 8 tab, 8 ref.

Descriptors: *Streamflow, *Model studies, *Synthetic hydrology, *Simulation analysis, Mathematical models, Stochastic processes, Analytical techniques, Hydrology, Rivers, Frequency, Distribution patterns, Low flow, Monthly, Persistence, Time series analysis, Foreign research.
Identifiers: *United Kingdom.

Details are given of some problems which have been encountered during the development of a set of river flow data generation procedures. The adopted methods followed the principles of time series analysis, and both monthly and daily flows were studied. Three aspects were mentioned in the paper: Firstly, the use of an objective rescaled range analysis as an index of long-term persistence was outlined, and some imperfections in the technique were apparent from results obtained using real data. The second topic concerned the fitting techniques used to select a frequency distribution for the residuals obtained from an autoregressive analysis. It was shown that maximum likelihood estimators will give parameter values which differ from those obtained by the method of moments. Thirdly, tests for independence of residuals after a daily analysis were studied, and the value of the run test in rejecting certain series of residuals was shown. The importance of testing synthetic flows, with particular reference to their long-term cumulative low flow sequences, was also stressed. To be of value for reservoir yield estimation, synthetic river flow data sequences should pass value for reservoir yield estimation, synthetic river flow data sequences should pass the following tests: (a) Both daily (where appropriate) and monthly statistics should be comparable with their historic counterparts. Particular care is required in checks of serial correlation coefficients. (b) The Hurst exponent H values (or some other index of long term persistence) for the synthetic and historical flows should be similar. (c) The cumulative low flow sequences should be correctly reproduced. (See also W77-06708) (Humphreys-ISWS)
W77-07657

ON DETERMINISTIC COMPONENTS IN NATURAL STREAMFLOW,
Akademiya Nauk SSSR, Moscow. Scientific Research Inst. of Electroenergetics.
For primary bibliographic entry see Field 2E.
W77-07658

NEW FORMS OF CORRELATION RELATIONSHIPS BETWEEN POSITIVE QUANTITIES APPLIED IN HYDROLOGY,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
I. O. Sarmanov.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 104-109, 1974. 7 ref.

Descriptors: *Correlation analysis, *Hydrologic systems, *Mathematical studies, *Statistical methods, Mathematical models, Hydrology, Hydrologic aspects, Stochastic processes, Equations, Theoretical analysis, Analytical techniques, Foreign research.
Identifiers: *USSR, Gamma correlation, Symmetric gamma correlation, Non-symmetric gamma correlation.

The theory of correlation between positive stochastic variables was used to construct mathematical models of hydrological processes. This paper described the theory of symmetric and non-symmetric gamma correlation and of random gamma processes. New forms of uniform correlation

leading to gamma correlation also were described. (See also W77-06708) (Humphreys-ISWS)
W77-07659

SIMULATION OF DAILY RAINFALL SERIES USING MARKOV CHAIN MODELS,
Institute for Water Resources, Belgrade (Yugoslavia).
S. Jovanovic, A. R. Dakkak, M. Cabric, and M. Brajkovic.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 110-120, 1974. 7 fig, 5 tab, 5 ref.

Descriptors: *Markov processes, *Stochastic processes, Europe, Simulation analysis, Model studies, Rainfall, Gaging stations, Monte Carlo method, Wet seasons, Dry seasons, Statistical methods, Seasonal, Foreign countries, Foreign research.
Identifiers: *Zapadna Morava River Basin (Yugoslavia), *Daily rainfall, *Yugoslavia, Rainfall series, Markov chain models, Statistical analysis.

A model was developed to synthesize the seasonal daily rainfall in the season March-June at 22 rain-gauging stations located over the vast watershed of the Zapadna Morava River basin. Using the Monte Carlo technique, a Markov chain model was utilized for the simulation of wet and dry spell sequences, and a first-order Markov chain model was used for daily rainfall depth series generation. Statistical analysis was performed to test whether the historical and synthetic data belonged to the same population. (See also W77-06708) (Roberts-ISWS)
W77-07660

THE GENERATION OF SYNTHETIC MONTHLY RUNOFF RECORDS FOR UNGAUGED BRITISH CATCHMENTS,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
B. M. J. Barton.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 121-133, 1974. 5 fig, 2 tab, 19 ref.

Descriptors: *Synthetic hydrology, *Gaging stations, *Monthly, *Runoff, Soil types, Topography, Stochastic processes, Transpiration, Precipitation (Atmospheric), Geology, Precipitation gages, Potential flow, Foreign countries, Foreign research.
Identifiers: *British catchments, *Synthetic runoff record, Stochastic runoff, Potential transpiration, Two-stage catchment model, Prototype catchment, Ungauged river catchments.

A technique was developed which permits a synthetic record of stochastic monthly runoff to be generated for any British catchment, gaged or ungauged. The technique involves the generation and routing of synthetic monthly records of catchment precipitation and potential transpiration through a simple two-stage catchment model to yield the corresponding monthly synthetic runoff record. The parameters which define the model were obtained in each case from a correlation with the topography, geology, and soil type of the prototype catchment under investigation. (See also W77-06808) (Robert-ISWS)
W77-07661

MULTIDIMENSIONAL STATISTIC MODELLING OF HYDROLOGICAL PROCESSES ON THE BASIS OF STRUCTURAL ANALYSIS OF THE EMPIRICAL HYDROGRAPHS OF RUNOFF,
Siberian Energy Inst., Irkutsk (USSR).

G. A. Grinevich, A. G. Grinevich, and A. F. Solovjova.

In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 134-139, 1974. 11 ref.

Descriptors: *Statistical methods, *Runoff, *Model studies, Hydrographs, Hydrograph analysis, Stochastic processes, Time series analysis, Statistical models, Probability, Data collections, Geophysics, Time lag.
Identifiers: *Statistical analysis, *Empirical hydrographs, Probabilistic estimates, Hydrological processes, Geophysical processes, Cosmic processes.

Methods of Statistical analysis by decomposition of empirical hydrographs of runoff were described. By means of the proposed methods, properties of the component stochastic processes of runoff changes in different timeintervals were exposed. Methods of compositional statistic modelling of possible combinations of the properties of principal component processes were developed, which gives a possibility of obtaining probabilistic estimates of rarely observed situations. (See also W77-06708), (Roberts-ISWS)
W77-07662

STOCHASTIC DIFFERENCE EQUATION MODELLING OF HYDROLOGICAL PROCESSES,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-07663

STRUCTURAL RELATION BETWEEN PARAMETRIC AND STOCHASTIC HYDROLOGY MODELS,
Pittsburgh Univ., Pa.
R. G. Quimpo.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 151-157, 1974. 2 fig, 15 ref. NSF GK-20388.

Descriptors: *Model studies, *Parametric hydrology, *Streamflow, *Hydrographs, Unit hydrographs, Synthetic hydrology, Statistical methods, Mathematical models, Analytical techniques, Analysis, Correlation analysis, Hydrology, Rainfall-runoff relationships, Stochastic processes, Markov processes.

To reconcile techniques of parametric and stochastic hydrology, the structural relation between unit hydrograph and hydrological time series models was investigated. Using autocorrelation analysis, the parameters of the instantaneous unit hydrograph were related to the autoregressive coefficients of a stochastic model for streamflow. The autocorrelation function of the Dooge-Nash model (with parameters n and K) was obtained in terms of a modified Bessel function of the second kind with order $n - 1/2$, whose argument is the inverse of the storage coefficient K . Generalized curves were presented which allow graphical estimation of hydrograph parameters from the autocorrelation characteristics of the hydrograph. The use of the technique was illustrated in an example. The mathematical development demonstrated the structure of the linkage between linear models of stochastic and parametric hydrology. The key to this linkage is in the kernel function of the storage model for the system. Given parameters of the instantaneous unit hydrograph, one is able to determine the parameters of the corresponding autoregressive model for the time series representing system response. (See also W77-06708) (Humphreys-ISWS)
W77-07664

Field 2—WATER CYCLE

Group 2A—General

SIGNIFICANCE TESTS OF PERIODICITY IN HYDROLOGICAL TIME SERIES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
V. Yevjevich.

In: *Mathematical Models in Hydrology*, Volume 1; Proceedings in the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 158-168, 1974. 11 fig, 1 ref.

Descriptors: *Parametric hydrology, *Model studies, *Statistical methods, *Hydrology, Frequency, Analytical techniques, Analysis, Time series analysis, Variability, Statistics, Correlation analysis, Precipitation (Atmospheric), Rainfall, Runoff, Mathematical models, Probability, Stochastic processes, Mathematical studies.

The main parameters of hydrological discrete time series, with the time interval a fraction of a year, are periodic. Detection of significant harmonics in these parameters is required when their identification and removal lead to a stationary (and presumably also ergodic) independent or dependent stochastic component of a prescribed order of stationarity. When a hydrological variable, or its logarithm, can be justifiably expressed as a sum of a periodic parameter and a stochastic stationary component, the classical Fisher's test of detecting significant harmonics is applicable. Because these simple sums are not always found in hydrological time series, an empirical approximate method was presented for performing tests. Examples of three precipitation and two runoff discrete time series were given, with the cumulative percentage of explained variance by the sum of any first m harmonics out of $\omega/2$ possible harmonics. Periodicity is always present in the mean and standard deviation of both precipitation and runoff series, no periodicity in the serial correlation coefficients in precipitation, and in runoff series when rainfall predominately contributes to runoff, but show periodicity in these coefficients when the runoff is fed by both rainfall and snowmelt. (See also W77-06708) (Humphreys-ISWS)
W77-07665

A SIMPLE STOCHASTIC MODELLING OF HURST'S LAW,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-07666

IN HYDROLOGY H IS A HOUSEHOLD WORD,
IBM Thomas J. Watson Research Center, Yorktown Heights, N. Y.
J. R. Wallis, and N. C. Matalas.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 196-203, 1974. 7 fig, 8 ref.

Descriptors: *Flow, *Synthetic hydrology, *Model studies, Mathematical models, Persistence, Correlation analysis, Streamflow, River flow, Runoff, Time series analysis, Equations, Markov processes, Statistical methods, Statistics, Hydrology, Precipitation (Atmospheric).
Identifiers: Serial dependence.

Empirical correlograms subjectively reflect long-term persistence, yet objective tests for serial dependence fail to do so because of biases in the estimates of the test statistics as well as the inherent low power of the tests. To generate synthetic flows, resemblance between historical and synthetic sequences requires the use of values for statistical characteristics that are different from those extracted from the historical sequences. (See also W77-06708) (Sims-ISWS)
W77-07667

FREQUENCY ANALYSIS OF WATER BALANCE COMPONENTS IN RELATION TO CLIMATIC FACTORS,
Ebasco Services, Inc., New York.
B. S. Browzin.

In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 204-211, 1974. 3 fig, 5 tab, 6 ref.

Descriptors: *Watersheds (Basins), *Precipitation (Atmospheric), *Runoff, *Great Lakes, *St. Lawrence River, Evaporation, Storage, Climatology, Climates, Water balance, Data processing, Analytical techniques, Rainfall, Snowfall, Water resources, Annual, Seasonal, Variability, Meteorology, Hydrology.
Identifiers: *St. Louis River.

The variation of both annual and seasonal values of precipitation, runoff, evaporation, deficit, and catchment storage in four selected basins from different climatic conditions was studied. The variation of monthly flow is large, and in certain months it is excessively large. The variation of monthly flow is influenced by the variation of precipitation as seen in this study, but the variation is also influenced by other causes, especially by variation of temperatures. The monthly flow variation is larger than the variation of monthly precipitation. In the basin of the St. Louis River, which is located in a pronounced continental climate, the variation in flow is considerably different as compared with the three other rivers located in transient and oceanic climate. The ratio C/F of warm to cold season precipitation is an index which marks the hydrological conditions conveniently to segregate river basins according to climate. This index is 2.52 for St. Louis, and 1.55 to 0.99 for the three other river basins. The variation in monthly water volume accumulations, in general, is large but erratic. (See also W77-06708) (Sims-ISWS)
W77-07668

MATHEMATICAL MODELS RESULTING FROM STATISTICAL ANALYSIS OF THE MEAN MONTHLY FLOW,
Ebasco Services, Inc. New York.
For primary bibliographic entry see Field 2E.
W77-07669

FLOOD FREQUENCY STUDIES OF RIVERS IN THE FEDERAL REPUBLIC OF GERMANY,
Technische Universität, Brunswick (West Germany). Leichtweiss Inst. for Water Research.
For primary bibliographic entry see Field 2E.
W77-07670

STOCHASTIC ANALYSIS OF SHORT-TIME RAINFALLS,
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 2B.
W77-07671

A STATISTICAL FILTRATION MODEL FOR THE INSEEPAGE OF MELT WATER INTO FROZEN GROUND,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 2G.
W77-07672

DETERMINATION OF THE DEGREE OF PROTECTION OFFERED BY FLOOD CONTROL SYSTEMS ON THE BASIS OF DISTRIBUTION FUNCTIONS,
Water Resources Centre, Budapest (Hungary).
For primary bibliographic entry see Field 8B.
W77-07673

STATISTICAL ANALYSIS APPLIED TO THE STUDY OF THE COMPONENTS OF A FLOOD WAVE,
Institutul de Meteorologie si Hidrologie, Bucharest (Rumania).
For primary bibliographic entry see Field 2E.
W77-07674

A MULTIVARIATE MATHEMATICAL MODEL OF MONTHLY RIVER FLOW,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Science and Engineering.
For primary bibliographic entry see Field 2E.
W77-07675

FINDING REGULARITIES IN LONG-TERM STREAMFLOW FLUCTUATIONS BY ANALYSIS OF HYDROLOGICAL ENSEMBLES,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
For primary bibliographic entry see Field 2E.
W77-07676

OPTIMAL SPATIAL INTERPOLATION AND ITS ERRORS IN THE CASE OF VARIOUS DISTANCES BETWEEN OBSERVATION POINTS OR WATERSHED CENTRES,
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
For primary bibliographic entry see Field 4D.
W77-07677

OBJECTIVE ANALYSIS OF SNOW COVER FIELDS,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 2C.
W77-07678

USE OF CROSS-CORRELATION TECHNIQUES FOR DETERMINING THE RELATIONSHIP BETWEEN GROUNDWATER LEVELS AND SOURCES IN THE NILE DELTA AREA,
For primary bibliographic entry see Field 2F.
W77-07679

TIME AND FREQUENCY-DOMAIN IDENTIFICATION OF A CASUAL BIVARIATE STOCHASTIC PROCESS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2E.
W77-07680

APPLICATION OF STOCHASTIC HYDROLOGICAL MODELS IN THE DESIGN OF LAKE LEVEL CONTROL,
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 4A.
W77-07681

SOME ARITHMETICAL RELATIONS OF A MATRIX FOR A CALCULUS OF RESERVOIRS, (QUELQUES RELATIONS ARITHMETIQUES DE MATRICE DANS LE CALCUL DES RESERVOIRS),
Direction des Eaux, Baja (Hungary).
For primary bibliographic entry see Field 4A.
W77-07682

EMPTINESS OF A FINITE DAM—TIME DEPENDENT THEORY,
Indian Inst. of Tech., Madras. Dept. of Mathematics.
For primary bibliographic entry see Field 8B.
W77-07683

MULTIPLE MARKOV PROCESSES IN HYDROLOGY AND THEIR IMPORTANCE FOR STOCHASTIC ANALYSIS OF WATER ACCUMULATION PROBLEMS,
Technical Univ. of Prague (Czechoslovakia).
For primary bibliographic entry see Field 4A.
W77-07684

MATHEMATICAL MODELS OF RUNOFF FOR THE COMPUTATION OF STORAGE RESERVOIRS,
Tbilisskii Gosudarstvennyi Universitet (USSR).
Dept. of Hydrology.
For primary bibliographic entry see Field 4A.
W77-07685

MODEL OF A LAKE RESERVOIR,
Wasserwirtschaftsdirektion, Halle, (East Germany).
For primary bibliographic entry see Field 4A.
W77-07687

SOME PROBLEMS OF STOCHASTIC STORAGE WITH CORRELATED INFLOW,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
For primary bibliographic entry see Field 4A.
W77-07689

TIDAL AND CURRENT PREDICTION FOR THE AMAZON'S NORTH CHANNEL USING A HYDRODYNAMICAL-NUMERICAL MODEL,
Naval Postgraduate School, Monterey, Calif.
For primary bibliographic entry see Field 2L.
W77-07743

REPRESENTATIVE AND EXPERIMENTAL BASINS - WHERE NEXT,
Hydrocomp, Inc., Palo Alto, Calif.
R. K. Linsley.
Hydrological Sciences Bulletin, Vol. 21, No. 4, p 517-529, December 1976. 13 fig, 13 ref.

Descriptors: *Basins, *Watersheds(Basins), *Overland flow, *Simulation analysis, Urbanization, Channels, Subsurface runoff, Water quality, Model studies, Bench marks.
Identifiers: *Stanford watershed model, Deforestation, Experimental basins.

Discussed are some of the problems of basin studies, such as the relative sizes of different basins, overland flow, and interflow between different basins. Simulation of basins was considered, particularly the use of the Stanford Watershed Model and how it can be applied to investigate changes due to urbanization and deforestation. The future role of representative and experimental basins was discussed. (Bhowmik-ISWS)
W77-07781

PENN STATE URBAN RUNOFF MODEL--USER'S MANUAL,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W77-07797

STUDY OF THE RIO GRANDE, BOLIVIA HIGHLIGHTS SOME BASIC QUESTIONS ABOUT SIMULATION,
Hydrocomp, Inc., Palo Alto, Calif.
R. C. Johanson.
Simulation Network Newsletter, Vol. 8, No. 8, p 1-8, December, 1976. 7 fig, 3 ref.

Descriptors: *Model studies, *Hydrologic data, Rivers, Precipitation(Atmospheric), Rainfall intensity, Computer models, Evaluation, Flow, Data collections, *Simulation analysis.
Identifiers: Hydrocomp Simulation Programming(HSP), *Rio Grande River(Bolivia).

A simulation study of the Rio Grande River, Bolivia, was performed which highlighted questions on the validity of simulation studies where data was incomplete. It was pointed out that there was no hourly continuous precipitation data available for use with Hydrocomp Simulation Programming (HSP). Opinion was presented on the need for this type of data to reduce errors in results and the relative importance of the number of gauges in simulation studies was stressed. Data on the Rio Grande was from five recording rain gauges covering a period of 1.5 years, including 81 daily records. A 30-year simulation was achieved by obtaining representative temporal distributions of daily precipitation. The calendar year was divided into rainfall seasons in which classes are identified based on quantity of daily precipitation. These formed a matrix of seasons and daily precipitation classes which made a two-way scheme for classifying any day's precipitation. Available hourly data was tallied into daily totals. Each value in the daily data record was disaggregated by random choice of a 24-hour sequence. After disaggregation of precipitation data, the HSP model was calibrated against observed streamflow in the usual way. The 30-year simulation for the river was calculated with and without a proposed dam. Results were shown to have good agreement with earlier findings and most error was very small. (Collins-FIRL)
W77-07945

HYDROLOGIC OPTICS. VOLUME I. INTRODUCTION,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07956

OBJECTIVE FUNCTION AND CONSTRAINTS IN WATER RESOURCES SYSTEMS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6A.
W77-08046

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS--I,
Illinois Univ. at Urbana-Champaign. Hydrosystems Lab.
For primary bibliographic entry see Field 4A.
W77-08047

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS--II,
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-08048

PLANNING OF SYSTEMS FOR REGIONAL DEVELOPMENT IN WATER RESOURCES,
Technion-Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 6A.
W77-08049

LAND USE CLASSIFICATION FOR HYDROLOGIC MODELS USING INTERACTIVE MACHINE CLASSIFICATION OF LANDSAT DATA,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W77-08074

REMOTE SENSING INPUTS TO WATER DEMAND MODELING,
California Univ., Santa Barbara. Geography Remote Sensing Unit.
For primary bibliographic entry see Field 7B.
W77-08080

2B. Precipitation

SIMULATION OF DAILY RAINFALL SERIES USING MARKOV CHAIN MODELS,
Institute for Water Resources, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 2A.
W77-07660

FREQUENCY ANALYSIS OF WATER BALANCE COMPONENTS IN RELATION TO CLIMATIC FACTORS,
Ebasco Services, Inc., New York.
For primary bibliographic entry see Field 2A.
W77-07668

STOCHASTIC ANALYSIS OF SHORT-TIME RAINFALLS,
Technical Univ. of Budapest (Hungary).
J. Winter.

In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971; International Association of Hydrological Sciences Publication No. 100, p 226-232, 1974. 4 fig, 5 ref.

Descriptors: *Rainfall, *Curves, *Model studies, Duration curves, Probability, *Stochastic processes, Data processing, Analysis, Analytical techniques, Summer, Monthly, Probable maximum precipitation, Precipitation(Atmospheric), Distribution, Temporal distribution, Meteorology, Hydrology, Foreign research, Foreign countries.
Identifiers: *Hungary.

Research work was carried out in the Chair for Water Management of the Technical University of Budapest to establish certain rules for short-time rainfalls. It was found that the applicability of a certain distribution function does not depend only on a good fit to observed data. Additional features that were considered were the physical realities in the ranges of low and high probability, the accuracy in determining the parameters, and the trends of change of the parameters in space and time. With regard to all these points, short-time rainfalls were found to be characterized best by aid of the logarithmic normal distribution function. Since logarithmic normal distribution functions calculated for the four summer months (May through August) were found to be almost identical, it became possible to process the data of these four months together, which resulted in the multiplication of the number of data to be involved in determining the function. The reliability of estimation was thus increased considerably. The relationships established between rainfall height, duration, and probability may be applied with advantage in the dimensioning of drainage canals. (See also W77-06708) (Sims-ISWS)
W77-07671

OBJECTIVE ANALYSIS OF SNOW COVER FIELDS,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 2C.
W77-07678

CHARACTERISTICS OF THE SEVERE RAINSTORM,
Tokyo Aviation Weather Service (Japan).
M. Shimada.
Geophysical Magazine, Vol. 37, No. 4, p 271-307, March 1976. 31 fig, 4 tab, 33 ref.

Descriptors: *Storms, *Rainfall, *Excessive precipitation, Cloudbursts, Storm water, Runoff, Design storm, Air masses, Cloud physics, Floods, Disasters, Fronts(Atmospheric), Weather, Meteorology.
Identifiers: *Severe rainstorms, *Japan, Synoptic structure, Mesoscale analysis, Rainstorms characteristics.

Field 2—WATER CYCLE

Group 2B—Precipitation

The characteristics of the several rainstorm which is accompanied by no remarkable synoptic disturbance were investigated. It was shown that the synoptic situation where the severe rainstorm occurs can be classified into three types, referring to the contour pattern of 500-mb surface maps. Two types of synoptic situations occur in relation to the location of the middle latitude high, and the other type of synoptic situation occurs in relation to the location of the upper cold vortex. Some characteristics were found peculiar to each type. It was shown that the position of the rainstorm is given relative to a particular pattern on the 500-mb map for each type, especially in relation to the location of the middle level jet axis. Association with the low level jet is confirmed for the first type, but not so clearly for the second and third types. Existence of the moist tongue is confirmed for the first and the third types, but not for the second type. Rainstorms of the first and the third types occur rather frequently in the nighttime, but not of the second type. A rainfall area of the first type is relatively large, but the area of the second and the third types is small. Duration of the rainfall is relatively long for the first type and short for the second and the third types. Association with the mesoscale disturbances is always confirmed for all the three types by mesoanalyses. Some parts of a rainfall area move with the mesoscale disturbance and others remain stationary. The results showed a close linkage between the synoptic situation and the mesoscale features of the severe rainstorm. (Sims-ISWS)
W77-07784

ANALYSIS OF IFYGL RAWINSONDE BASELINE MEASUREMENTS.
National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service; National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
S. Williams.
Technical Memorandum EDS CEDDA-8, July 1976. 13 p, 5 tab, 1 append.

Descriptors: *Radiosondes, *Instrumentation, *Telemetry, *Great Lakes, Temperature, Humidity, Atmosphere, Weather data, Calibrations, *Measurement, Meteorology.
Identifiers: *International Field Year for the Great Lakes, *Rawinsonde instrumentation, Hygristors, Thermistors.

Comparisons were made between factory and field baseline measurements of the rawinsonde instrumentation used during the International Field Year for the Great Lakes (IFYGL) in 1972-73. No independent check data were available, but it is believed that the comparisons make it possible to set a limit on the accuracy expected from manual baseline measurements. A simpler and more accurate baseline procedure was suggested. (Sims-ISWS)
W77-07790

STUDY OF THE RIO GRANDE, BOLIVIA HIGHLIGHTS SOME BASIC QUESTIONS ABOUT SIMULATION.
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2A.
W77-07795

THE MEASUREMENT OF RAINFALL AT GROUND LEVEL.
Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
R. Aldridge.
Journal of Hydrology (New Zealand), Vol. 15, No. 1, p 35-40, 1976. 4 tab, 7 ref.

Descriptors: *Rainfall, *Measurement, *Rain gauges, Rainfall intensity, On-site investigations, Precipitation (Atmospheric), Rain, Foreign research, Foreign countries, Slopes, Data

processing, Climatic data, Correlation analysis, Climatology, Meteorology.
Identifiers: *New Zealand, Ground level rain gauges, Tilted rain gauges, Rain gauge exposure, Rainfall measurement.

For comparative studies of rainfall, the use of rain gauges similarly exposed at a height of 0.3 m above ground level is acceptable as a practical method. Errors of measurement are inherent in the exposure of rain gauges in this manner, and accurate point measurement of rainfall is not achieved. A possible solution to this problem is the exposure of rain gauges at ground level. To study the differences between the catch of rain gauges at 0.3 m and at ground level at Taita Experimental Station, Lower Hutt, New Zealand, a rain gauge exposed at ground level, in addition to the rain gauge at 0.3 m, has been in use in the climatological enclosure since March 1971. In addition to this comparison, a plot was set up on a hill site to study the differences in catch amongst a ground-level rain gauge, tilted rain gauges, and vertical rain gauges on a steep slope. In the climatological enclosure over the period April 1971 to June 1974 there were 525 raindays, with data available for both rain gauges. For this 39-month period, the total rainfall catch of the ground-level rain gauge exceeded the total catch of the rain gauge at a height of 0.3 m by 6.3% with a monthly difference ranging from 0.6% to 13.5%. On a daily basis the percentage differences in the catch of the rain gauges generally decreases with increasing rainfall. For the hill site from December 1971 to December 1972, the total mean catch of the vertical rain gauges was 13.5% less than the catch of the ground-level rain gauge. This was a larger difference between the rain gauges at 0.3 m and ground-level than had been found in the horizontal climatological enclosure over the same period. (Sims-ISWS)
W77-08061

2C. Snow, Ice, and Frost

OBJECTIVE ANALYSIS OF SNOW COVER FIELDS.
Hydrometeorological Service of the USSR, Moscow.
E. P. Chmerenko.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 315-318, 1974. 1 fig, 3 ref.

Descriptors: *Snow cover, *Data processing, *Analytical techniques, Networks, Precipitation (Atmospheric), Snow, Snowfall, Water resources, Statistical methods, Analysis, Hydrology, Meteorology, Foreign research, Foreign countries.
Identifiers: *USSR, Interpolation, Objective analysis.

A procedure for automatic processing of data on snow cover for the purposes of hydrological forecasting was described. Observations on snow cover depth and its water content are read into the computer which then sorts them as follows: The whole territory under study is divided into equal squares whose area is determined by the mean density of the observation network in such a way that each station falls into some square. The position of the first and last station in each square is held in the computer memory, which facilitates the selection of the required information. The coordinates of the interpolation point determine the number of the square in which the point in question is located. This number permits the selection of the data from the stations located within this square. Where these stations are too few, the stations located in the neighboring squares are selected. Then, of the total number of the stations selected, a certain proportion of the nearest stations is selected, and their data are used for interpolation purposes. When the objective analysis is carried out under optional conditions, the selec-

tion of the interpolation method is of great importance. The following conclusions were noted from the objective analysis of snow cover: The variable snow depth and water content are characterized by considerable spatial variability due to the irregularity of solid precipitation. Moreover, like all variables measured near the earth's surface, a noticeable influence of microclimatic peculiarities of the underlying surface often causes observations on snow cover to be unrepresentative, while the interest variability in the snow cover water content is often very large. It is difficult, therefore, to formulate an objective criterion for use in deciding when snow cover data should be rejected. (See also W77-06708) (Sims-ISWS)
W77-07678

OIL SPILL AT DECEPTION BAY, HUDSON STRAIT.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 5G.
W77-07731

ICE MOVEMENTS IN THE BEAUFORT SEA 1973-1975: DETERMINATION BY ERTS IMAGERY.
Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
L. W. Sobczak.
Journal of Geophysical Research, Vol. 82, No. 9, p 1413-1418, March 20, 1977. 4 fig, 1 tab, 7 ref.

Descriptors: *Sea ice, *Movement, *Winds, *Remote sensing, *Arctic, Ice cover, Polar regions, Cold regions, Satellites (Artificial), Ice, Spring, Data processing, Analytical techniques.
Identifiers: *ERTS, *Beaufort Sea, Sea ice movements.

Remote sensing (ERTS) imagery was used to map the distribution of leads in the sea ice over the Beaufort Sea during late February through early April in 1973, 1974, and 1975. A comparison of the bearings and speeds of ice movements obtained from ERTS-based maps with those of geostrophic winds calculated from average daily and weekly atmospheric pressure charts indicated that the ice drifts at about 1/100 of the speed of the geostrophic winds in a direction about 20 degrees to the left. During early March 1973, before excessive ice breakup, the sea ice moved slowly, about 0.3 km/d, but during periods of rapid ice fracturing (March and April 1975), the sea ice moved at rates as high as 18.2 km/d. (Sims-ISWS)
W77-07769

AN EXPERIMENTAL AND THEORETICAL STUDY OF THE TURBULENT AND LAMINAR CONVECTION GENERATED UNDER A HORIZONTAL ICE SHEET FLOATING ON WARM SALTY WATER.
Washington Univ., Seattle, Dept. of Oceanography.
S. Martin, and P. Kauffman.
Journal of Physical Oceanography, Vol. 7, No. 2, p 272-283, March 1977. 9 fig, 4 tab, 12 ref. ONR N00014-76-C-0234

Descriptors: *Ice, *Melting, *Water temperature, *Convection, Laboratory tests, Model studies, Mathematical models, Salinity, Salts, Thermal conductivity, Heat flow, Temperature, Sea water, Turbulence, Laminar flow, Sea ice, Ice-water interfaces, Oceans, Polar regions, Oceanography.
Identifiers: *Floating ice, Ice sheets.

In an experimental and theoretical study, a phenomenon was modeled which occurs in the summer polar oceans; namely, the melting of flat sheets of either glacial ice or desalinated sea ice which float over seawater held at a temperature above freezing. Laboratory results showed that when the solution salinity is such that the temperature of maximum density is below the freezing

temperature, or for seawater salinities greater than 25 parts per thousand, the heat transfer to the ice takes place in three regions. First, just beneath the ice there is a boundary layer across which the salinity increases almost to its far-field value, and the temperature increases linearly. Below the first layer, there is an unstable convective boundary layer, which appears to be part double-diffusive, part pure thermal convection. Finally, there is a region of deep thermal convection. From comparison of a one-dimensional theoretical model of the heat transfer with the laboratory study, it was found that the ice melts about twice as fast for this convective case as for a purely diffusive heat transfer model. (Sims-ISWS)

W77-0773

HEAT AND SALT TRANSFER ASSOCIATED WITH FORMATION OF SEA-ICE, Cambridge Univ., (England). Dept. of Applied Mathematics and Theoretical Physics. J. E. Weber.

Tellus, Vol 29, No 2, p 151-160, 1977. 3 fig, 1 tab, 30 ref, 1 append.

Descriptors: *Sea ice, *Salinity, *Freezing, *Model studies, Mathematical models, *Heat transfer, Salts, Ice-water interfaces, Sea water, Mixing, Convection, Water temperature, Water circulation, Oceans, Oceanography. Identifiers: *Sea ice formation, *Salt rejection.

The transient state of sea-ice formation due to a given constant drop in surface temperature, and the associated change in sea-water salinity due to salt rejection, has been investigated theoretically by the heat balance integral method. The water temperature was taken to be constant. Ice, water, and salt were assumed to coexist in thermodynamic equilibrium at the ice-water interface, and the analysis is valid for small temperature perturbations. The ice growth rate was found to be reduced considerably due to the depression of the freezing point caused by salt rejection. Haline convection with typical wavelength 1-2 mm was found to occur after a characteristic time of order 1 min. Results also were presented for the ice growth problem when the ice-water interface can be regarded as a constant temperature boundary. Some effects of variable thermal properties due to brine trapping in the ice were taken into account. The case of a time-dependent surface temperature also was considered. (Sims-ISWS)

W77-0776

ELECTRICAL RESISTIVITY MEASUREMENTS ON THE ROSS ICE SHELF, Wisconsin Univ. Madison. Dept. of Geology and Geophysics.

C. R. Bentley. Journal of Glaciology, Vol. 18, No. 78, p 15-35, 1977. 17 fig, 2 tab, 20 ref, append. NSF GV-36963.

Descriptors: *Ice, *Electrical resistance, *Antarctic, Snow, Snowpacks, Electrical properties, On-site investigations, Measurement, Surveys, Data processing, Model studies, Mathematical models, Glaciers, Glaciology. Identifiers: *Ice shelves, *Ross Ice Shelf.

Electrical resistivity measurements were made along two perpendicular profiles on the Ross Ice Shelf, Antarctica, in 1973-74. Apparent resistivities generally are well determined at electrode separations from 10 m out to 600 m, where the effect of the highly conducting seawater beneath the shelf becomes strongly felt. Schlumberger and equatorial-dipole data are in excellent agreement on each profile; apparent resistivities on the two profiles, however, differ by about 12% at separations greater than about 30 m. This apparent anisotropy is attributed to a presumed inhomogeneity at a few tens of meters depth, rather than to true anisotropy in the bulk resistivity. A computer program was developed to calculate apparent resistivities on an ice shelf in which the

density and temperature, and thus the resistivity, vary continuously with depth. Temperatures were calculated for a steady-state ice shelf; densities were calculated from seismic velocity data. Several different models of the dependence of resistivity on density were tested—one appears to fit the observations very closely, but it must be accepted only with great caution because the assumptions on which it is based are violated in the ice shelf. (Sims-ISWS)

W77-08051

PENETRATION DEPTH OF CLOSELY SPACED WATER-FREE CREVASSES, Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences; and Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.

J. Weertman. Journal of Glaciology, Vol. 18, No. 78, p 37-46, 1977. 11 ref. NSF AER75-00187.

Descriptors: *Glaciers, *Ice, *Cracks, *Model studies, Mathematical models, Failure (Mechanics), Fractures (Geologic), Faults (Geologic), Tensile strength, Mechanical properties, Glaciology. Identifiers: *Crevasse.

An approximate, analytic solution was found for the profile of a water-free crevasse in a field of closely spaced crevasses. The depth of penetration of the crevasses into the glacier was found. If the fracture strength of ice is taken to be zero, the penetration depth is equal to the value found by Nye and is independent of the crevasse spacing. This conclusion is in disagreement with results reported recently by R.A. Smith. If the fracture strength of ice is taken to be finite, the penetration depth is reduced if the spacing between crevasses is reduced. The results of the analysis can be applied to other crack problems. In particular, it can be applied to thermal, secondary cracking that occurs when cooling fluid flows through the cracks created by hydraulic fracture for the purpose of extracting geothermal heat from hot, dry rock masses. (Sims-ISWS)

W77-08052

ENERGY EXCHANGE AT A GLACIER SURFACE: AN ALTERNATIVE TO AERODYNAMIC METHODS OF MEASUREMENT, British Antarctic Survey, Cambridge (England).

A. C. Wager, and A. W. Jamieson. Journal of Glaciology, Vol. 18, No. 78, p 47-55, 1977. 3 fig, 1 tab, 11 ref.

Descriptors: *Glaciers, *Energy transfer, *Antarctic, *Model studies, Mathematical models, Energy, Temperature, Density, Ice, Ablation, Melting, Freezing, Winds, Meteorology, Glaciology, Methodology, *Measurement. Identifiers: *Aerodynamic method.

Analysis of wind-speed measurements made over a six-month period on an Antarctic glacier showed that conditions near the surface are dominated by gravity winds flowing downhill. In such conditions there is no satisfactory method of calculating the amount of energy exchanged between the glacier and the atmosphere. Also it is difficult to extrapolate satisfactorily energy changes measured at a single point to the whole glacier. Moreover, the loss of five days' meteorological records may cause an error as large as the total change in energy content of the glacier during a year. In view of these difficulties, it is more fruitful to measure the changes in energy content of the glacier directly. This can be done by accurate measurements of ice temperature and density near the surface. By defining the total energy content of a glacier as the heat required to melt it, fractional changes in the energy content and mass occurring over a year are equal and indicate the probable lifetime of the glacier. Estimates based on data from an Antarctic glacier suggest that the long-term change of energy of the glacier (about 1.5 W/sq m) could be mea-

sured with an accuracy of 10% within a year. (Sims-ISWS)

W77-08053

A SNOW-BANK PUSH MECHANISM FOR THE FORMATION OF SOME 'ANNUAL' MORAINÉ RIDGES, Aberdeen Univ. (Scotland). Dept. of Geography.

R. V. Birnie. Journal of Glaciology, Vol. 18, No. 78, p 77-85, 1977. 7 fig, 3 ref.

Descriptors: *Glaciology, *Geomorphology, *Glacial drift, *Antarctic, Glaciers, Till, Land forming, Snow, Movement, On-site investigations, Ablation, Glaciation, Ice. Identifiers: *South Georgia Island, Lucas Glacier, Ridges, Ridge formation.

Ice-marginal features in South Georgia include minor moraine ridges running approximately parallel to the ice margin and developed as superficial forms in various depths of till. It was suggested that these developed as ice-contact landforms, some being created by the interaction of the ice edge and abutting marginal snow bank, whilst the glacier is advancing. This advance is essentially short-term, being part of a seasonal variation in the position of the ice margin. 'Snow-bank push' is the term proposed to describe this mechanism of ridge formation. This process of 'snow-bank push' results in an extremely variable ridge form which rapidly loses its distinctive character. It soon becomes difficult to differentiate from ridges formed by alternative processes. (Humphreys-ISWS)

W77-08054

STATISTICAL FORECASTING OF SNOW AVALANCHES, SAN JUAN MOUNTAINS, SOUTHERN COLORADO, U.S.A., Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

M. J. Bovis. Journal of Glaciology, Vol. 18, No. 78, p 87-99, 1977. 4 fig, 10 tab, 7 ref. USBR 14-06-D-7155.

Descriptors: *Avalanches, *Forecasting, *Snow, *Colorado, On-site investigations, On-site data collections, Analytical techniques, Analysis, Statistical methods, Mathematical models, Snowpacks, Data processing. Identifiers: *San Juan Mountains (Colo), Wet slides, Dry slides.

Meteorological and snow pack variables were measured on chronologically ordered sequences of avalanche and avalanche-free days. Discriminant analysis was used to define a subset of variables, which produced an optimal separation of the two multivariate group means. Two seasons were identified in each of the years considered, corresponding to periods of dry- and wet-snow avalanches, and formed the basic stratification of avalanche days in the analysis. Days were stratified further within each season on the basis of magnitude and number of releases. Weather and snow parameters were integrated over variable time steps prior to each avalanche or avalanche-free day, which introduced a recursive element into the forecast method. The presented results indicate that the prediction of avalanche days using discriminant functions which are derived from a previous season requires a stratification of avalanche events by slide type and magnitude. The overall level of accuracy indicates that the method generally is most effective in predicting days that have at least three events greater than or equal to magnitude two. Since this type of day often has several soft-slab or wet-slab releases, many of which can reach the highway, the method may be used to assess the overall hazard along the highway at a given time. To date (1976), the use of a single critical value, or discriminant index, to determine the status of a given day has possessed the obvious merit of simplicity in a field situation. (Humphreys-ISWS)

Field 2—WATER CYCLE

Group 2C—Snow, Ice, and Frost

W77-08055

PRESENT AND PAST GLACIATION THRESHOLD IN THE CASCADE RANGE, WASHINGTON, U.S.A.: TOPOGRAPHIC AND CLIMATIC CONTROLS, AND PALEOCLIMATIC IMPLICATIONS.
Washington Univ., Seattle. Dept. of Geological Sciences; and Washington Univ., Seattle. Quaternary Research Center.
S. C. Porter.
Journal of Glaciology, Vol. 18, No. 78, p 101-116, 1977. 7 fig, 3 tab, 28 ref.

Descriptors: *Glaciation, *Washington, *Paleoclimatology, *Glaciology, Quaternary period, Topography, Statistical methods, On-site data collections, Climatic data, Regression analysis, Analytical techniques, Ablation, Precipitation (Atmospheric).
Identifiers: *Cascade Mountains (Wash), Glaciation threshold, Isoglacihypes.

Isoglacihypes depicting the configuration of the glaciation threshold in Washington broadly parallel the crest of the Cascade Range and curve around the west and south flanks of the Olympic Mountains. In both uplands, the glaciation threshold rises inland (eastward) with a mean gradient of 10-12 m/km. However, the gradient in the Cascades is more variable due to five east-trending troughs in the glaciation threshold surface that coincide with topographic depressions along the range crest and that apparently result from greater eastward penetration of moist maritime air. Mean accumulation-season precipitation correlates strongly (r squared = 0.86) with altitude of the glaciation threshold in the North Cascade Range, but the correlation of glaciation threshold with altitude of the July freezing isotherm, determined from the calculated July lapse rate within the mountains, is much weaker (r squared = 0.40). Multiple regression analysis relating independent climatic variables that affect the height of the glaciation threshold indicates that 90.4% of variance is explained by accumulation-season precipitation and estimated mean annual temperature at the glaciation threshold. The glaciation threshold during the greatest ice advance of the last (Fraser) glaciation in the southern North Cascade Range (c. 18,000-22,000 years B.P.) was 900 + or - 100 m below that of the present. Depression of the glaciation threshold by this amount probably resulted from a change in accumulation-season precipitation of no more than 30% from present values and a decrease in mean ablation-season temperature of 5.5 + or - 1.5 deg. (Humphreys-ISWS)
W77-08056

AREAL EXTENT OF SNOW ESTIMATION IN THE NORTHERN SIERRA NEVADA MOUNTAINS USING LANDSAT-1 IMAGERY.
California Univ., Berkeley. Remote Sensing Research Program.
For primary bibliographic entry see Field 7B.
W77-08081

SNOW SURVEY FROM SPACE, WITH EMPHASIS ON THE RESULTS OF THE ANALYSIS OF SKYLAB EREP S192 MULTISPECTRAL SCANNER DATA.
Environmental Research and Technology, Inc., Concord, Mass.
For primary bibliographic entry see Field 7B.
W77-08082

FACTORS AFFECTING SNOW ASSESSMENT FROM LANDSAT DATA.
National Environmental Satellite Service, Washington, D.C.
For primary bibliographic entry see Field 7B.
W77-08083

OPERATIONAL WATER MANAGEMENT APPLICATIONS OF SNOWCOVERED AREA OBSERVATIONS.
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W77-08084

2D. Evaporation and Transpiration

THE USE OF LYSIMETERS IN THE HYDROLOGICAL INVESTIGATION OF THE UNSATURATED ZONE.
Research Inst. for Water Resources Development, Budapest (Hungary).
G. Kovacs.
Hydrological Sciences Bulletin, Vol. 21, No. 4, p 499-516, December 1976. 7 fig, 1 tab, 5 ref.

Descriptors: *Hydrologic properties, *Lysimeters, *Instrumentation, *Water balance, *Air-earth interfaces, Soil water, Methodology, Infiltration, Evapotranspiration, Measurement, Hydrology, Soil water movement.
Identifiers: Field measurements.

Data from experimental basins are frequently used in models to find the surface runoff originating from a given precipitation. It is difficult to predict the response function of a basin to a forthcoming meteorological event from observed data in the past and to use these data for other areas or larger basins because little is known of the hydrological processes occurring in the soil moisture zone. To overcome these difficulties, the experimental areas have to be equipped with lysimeters. Lysimeters themselves can be regarded as small experimental areas. The study of their water balance assists not only the understanding of the influence of the soil moisture zone on surface runoff, but also the same investigation is required for the evaluation of the directly measured data. It is necessary, therefore, to classify the different types of lysimeters. Some hydrological parameters can be measured directly by lysimeters and there are suitable methods for the calculation of the other parameters. The relationships necessary for the evaluation of the measured data were summarized for the main types of lysimeter, and the data application was represented on the basis of practical experiments. (Adams-ISWS)
W77-07780

EVALUATION OF THERMAL X/5-DETECTOR SKYLAB S-192 DATA FOR ESTIMATING EVAPOTRANSPIRATION AND THERMAL PROPERTIES OF SOILS FOR IRRIGATION MANAGEMENT.
South Dakota State Univ., Brookings. Remote Sensing Institute.
For primary bibliographic entry see Field 7B.
W77-08079

2E. Streamflow and Runoff

FLOODFLOW FORMULAS FOR URBANIZED AND NONURBANIZED AREAS OF CONNECTICUT.
Geological Survey, Hartford, Conn. Water Resources Div.
For primary bibliographic entry see Field 4C.
W77-07612

SOME APPLICATIONS OF STOCHASTIC FLOW GENERATION.
Birmingham Univ. (England).
For primary bibliographic entry see Field 2A.
W77-07647

STOCHASTIC ANALYSIS OF VELOCITY FLUCTUATIONS IN A NATURAL STREAM CHANNEL.
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
M. J. Hall, and P. M. Johnson.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 26-38, 1974. 7 fig, 2 tab, 10 ref.

Descriptors: *Velocity, *Flow, *Fluctuations, *Stochastic processes, Turbulent flow, Rivers, Open channel flow, Natural flow, Turbulence, Current meters, Measurement, Analytical techniques, On-site investigations, Foreign research, Currents (Water).
Identifiers: *United Kingdom.

One of the major errors in current meter measurements of flow velocities in natural stream channels arises from the effect of low-frequency turbulent velocity fluctuations. The magnitude of this error has generally been estimated on the assumption that the velocity fluctuations are random in time. A study was carried out at a gauging station in the North of England, during which two-hour long series of velocity measurements were obtained at three depths in the same vertical of the cross section. Objectives of study were: (1) to examine the time series of velocities at each point in the vertical for the presence of periodicities; (2) to examine the cross-correlation between synchronous velocity measurements in the same vertical; and (3) to determine the influence (if any) of the type of current meter on the results of (1) and (2) above. Analysis of these data revealed a concentration of variance at low frequencies, but no obvious periodic components. This correlation structure should be taken into account when quantifying the likely error in a limited-exposure point measurement of velocity. (See also W77-06708) (Humphreys-ISWS)
W77-07648

INVESTIGATIONS ON THE STRUCTURE OF FREQUENCY DISTRIBUTIONS OF FLOODS.
Technische Universitaet, Dresden (East Germany).
S. Dyck, and C. Kluge.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 39-46, 1974. 3 fig, 2 tab, 14 ref.

Descriptors: *Floods, *Flood frequency, *Statistical methods, Annual flood, Rainfall-runoff relationships, Watersheds (Basins), Hydrology, Precipitation (Atmospheric), Analytical techniques, Mathematical studies, Flow, Historic floods, Distributions, Foreign countries, Foreign research.
Identifiers: *German Democratic Republic, Multivariate analysis.

Because of numerous influences on the runoff process, which operate in a different manner for different flood values, variable behavior of the distribution function is to be expected. To improve knowledge, it is necessary to use all additional information, from deterministic as well as from statistical sources. In this paper several possibilities were discussed, especially the influence of physical thresholds, the statistical treatment of a sample of flood discharges exceeding a base flow, and the multivariate treatment of precipitation, retention, and discharge samples. (See also W77-06708) (Humphreys-ISWS)
W77-07649

BAYESIAN ESTIMATION OF FREQUENCY OF HYDROLOGICAL EVENTS.
Institute of Hydrology, Wallingford (England).
C. Cunnane, and J. E. Nash.

In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 47-55, 1974. 2 fig, 2 tab, 9 ref, 1 append.

Descriptors: *Hydrologic aspects, *Flood frequency, *Statistical methods, Flood forecasting, Flood recurrence interval, Mathematical studies, Frequency, Hydrology, Analytical techniques, Regional flood, Floods, Analysis.

A distinction was drawn between a sampling confidence interval and a probabilistic statement concerning the value of a population parameter. A method was developed which uses Bayes' theorem to combine the information of a regional flood frequency analysis and that of a sample of annual maxima to obtain a posterior probability distribution for a flood corresponding to a given return period. (See also W77-06708) (Humphreys-ISWS) W77-07650

STOCHASTIC STRUCTURE OF A PROCESS OF AVERAGE MONTHLY FLOWS,

Technical Univ. of Warsaw (Poland).
H. Mitosek, Jr.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 56-61, 1974. 1 fig, 3 tab, 8 ref.

Descriptors: *Average flow, *Statistical models, *Markov processes, Analytical techniques, Mathematical models, Foreign countries, Hydrology, Statistical methods, Correlation analysis, Mathematical studies, Monthly, River flow.
Identifiers: *Poland.

A stochastic structure of a process of monthly average flow is considered, and a procedure was developed for testing the null hypothesis of a model with independent variables against a simple Markov process as alternative. On basis of empirical data for nine stations in Poland, it was found that (1) the process $Q(t)$ of an average monthly inflow can not be considered as a process with independent variables; and (2) a very fair approximation to the process $Q(t)$ is furnished by a simple Markov model. (See also W77-06708) (Humphreys-ISWS) W77-07651

METHODS FOR THE MATHEMATICAL DESCRIPTION OF THE STRUCTURE OF RIVER RUNOFF VARIATIONS,

Hydrometeorological Service of the USSR, Moscow.
A. V. Rozhdestvensky.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 62-66, 1974. 1 fig, 2 tab.

Descriptors: *Runoff, *Statistical models, *Streamflow, Annual, Rivers, Foreign countries, Variability, Discharge(Water), Mathematical models, Mathematical studies, Statistical methods, Correlation analysis, Analytical techniques.
Identifiers: *USSR, Spectral analysis.

The structure of long-term river runoff variations was investigated by means of correlation and spectral analyses, as well as by methods of smoothing. On the basis of computations performed, the conclusion was reached that correlation and spectral functions, as well as the smoothed annual river runoff values combined with the use of the binomial filter, satisfactorily describe the structure of the cyclic river runoff variations within the observation period; but the correlation and spectral functions cannot be treated as characteristics of the process as a whole since they reflect the sporadic

fluctuations of the sampling data. (See also W77-06708) (Humphreys-ISWS) W77-07652

SPECTRAL ANALYSIS OF THE STRUCTURE OF HYDROLOGICAL SERIES,

A. I. Davydova.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 67-75, 1974. 4 fig, 8 ref.

Descriptors: *Streamflow, *Fluctuations, *Mathematical studies, *Runoff, Variability, Mathematical models, Statistical methods, Analytical techniques, Hydrology, Time series analysis, Foreign research, Foreign countries, Rivers, Cycles, Succession.
Identifiers: *USSR, Spectral analysis.

This paper examined the nature of long-range streamflow fluctuations for the purpose of investigating the internal structure of hydrological series. The mathematical techniques of the theory of stationary random processes were applied in order to obtain quantitative information on the structure of runoff series. In a study of the structure of long-term hydrological series, the basic interest lies in the regularities, their duration, and areal distribution of cyclic runoff fluctuations. The cyclic components of the runoff process were determined with the help of spectral analysis. A mathematical model was proposed for describing the deterministic component. Its essence lies in the fact that the empirical series are represented in the form of a complex harmonic structure that takes into account the effect of 2, 5, 7, and 11-year cycles in streamflow fluctuations. This model can be of use for gaining insight into the nature of runoff fluctuations for any water basin in the world. (See also W77-06708) (Humphreys-ISWS) W77-07653

SPATIAL AND TIME ANALYSIS AND ESTIMATION OF RIVER FLOW,

Moscow State Univ. (USSR). Dept. of Geography.
G. P. Kalinin, N. V. Nikolskaya, V. M. Evstigneyev, and V. A. Zhuk.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 76-79, 1974.

Descriptors: *Streamflow forecasting, *Discharge(Water), *Statistical methods, Streamflow, Rivers, Frequency, Frequency curves, Probability, Spatial distribution, Analysis, Runoff, Monthly, Annual, Foreign research.
Identifiers: *USSR, Coefficient of skewness, Ergodicity, Kurtosis.

A new principle of constructing probability distribution curves for characteristic streamflow values was suggested. The suggested principle is the application of the hypothesis of ergodicity to flow series which requires introducing the following changes: (1) The differences in statistical parameters due to territory should be taken into consideration in serial generalization. (2) In order to avoid the effect of correlation in generalizing serial observations, the dimensions of territories must be such that the effect of positive and negative correlations would be mutually cancelled. For investigations of the annual flow, the size of the territory must be at least 20 to 25 million sq km; for flows of other durations the size of territory can be less. (3) Since the present day samples of observations allows sufficiently accurate determination of only two statistical parameters (mean annual flow and coefficient of variation), success (at serial generalization) can be obtained only when the parameters of higher orders (coefficient of skewness and kurtosis excess E) are directly related to the precisely determined parameters. As it follows from theoretical considerations and con-

firmed by subsequent analysis of the observed data, this assumption generally holds satisfactorily. Equations for coefficient of skewness and E were tabulated for minimum daily discharges, minimum mean monthly discharges, flow during the dry season, flow during the wet season, maximum mean monthly discharges, maximum discharges, and mean yearly discharges. (See also W77-06708) (Humphreys-ISWS) W77-07654

ELEMENTS OF RUNOFF PERIODICITY IN TASKS OF MODELLING,

Gruzinskiy Nauchno-Issledovatel'skii Institut Gidrotekhniki i Melioratsii, Tiflis (USSR).
I. B. Khomeriki.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 80-84, 1974. 2 fig, 1 tab, 10 ref.

Descriptors: *Streamflow, *Mathematical models, *Statistical methods, *Runoff, Rivers, Statistical models, Frequency, Cycles, Annual, Stochastic processes, Monte Carlo method, Hydrologic aspects, Time series analysis, Foreign research, Probability, Succession.
Identifiers: *USSR.

Some aspects of the use of the Monte Carlo method in the research and modelling of the periodic elements of annual runoff were considered. An attempt was made to correlate model construction and cyclicity calculation in tasks of regulation. The Grenander-Rosenblatt method was proposed to find the spectral characteristics of a hydrological series. All the statements were based on the equivalence of two alternative hypotheses: (1) runoff is a stochastic process with a periodic trend; and (2) runoff is a stochastic process which does not contain regular components. (See also W77-06708) (Humphreys-ISWS) W77-07655

CYCLICAL STRUCTURE OF THE HYDROLOGICAL SERIES AND THE NATURE OF INDIVIDUAL COMPONENTS,

Siberian Energy Inst., Irkutsk (USSR).
S. G. Agarkov, I. P. Druzhinin, and Z. P. Konovalev.
In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No 100, p 85-90, 1974. 3 fig, 2 tab, 5 ref.

Descriptors: *Runoff, *Mathematical models, *Streamflow, *Rivers, Variability, Annual, Hydrological aspects, Hydrology, Air circulation, Cycles, Atmosphere, Foreign research, Statistical methods.
Identifiers: *USSR, Solar activity.

The cyclical structure of the annual river runoff of the USSR was confirmed by strict methods. The peculiarities of the river runoff variations in different atmospheric circulation epochs were exposed. By means of the coherence index, the relationship of both the 10 to 11-year components for the atmospheric circulation variations and river runoff variations with the solar activity was explained. The considered examples showed, on the one hand, the reality of the solar-hydrological relationships; but on the other hand, the examples indicated the great influence of the atmospheric circulation as an intermediate factor, which indicates the necessity of a more profound and careful study of the principal elements in the sequence leading from solar activity to river runoff. (See also W77-06708) (Humphreys-ISWS) W77-07656

Field 2—WATER CYCLE

Group 2E—Streamflow and Runoff

PROBLEMS ENCOUNTERED IN SYNTHETIC RIVER FLOW GENERATION PROCEDURES, Water Resources Board, Reading (England).
For primary bibliographic entry see Field 2A.
W77-07657

ON DETERMINISTIC COMPONENTS IN NATURAL STREAMFLOW, Akademiya Nauk SSSR, Moscow. Scientific Research Inst. of Electroenergetics.
N. S. Korganova, and N. A. Kartvelishvili.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 101-103, 1974. 4 ref.

Descriptors: *Streamflow, *Mathematical studies, *Natural streams, Mathematical models, Stochastic processes, Hydrology, Annual, Analytical techniques, Foreign research, Foreign countries.
Identifiers: *USSR.

The results were presented of research into the estimation by maximum likelihood of deterministic components in several years' record of a hydrological times series. (See also W77-06708) (Humphreys-ISWS)
W77-07658

NEW FORMS OF CORRELATION RELATIONSHIPS BETWEEN POSITIVE QUANTITIES APPLIED IN HYDROLOGY, Akademiya Nauk SSSR, Moscow. Institut Vodykh Problem.
For primary bibliographic entry see Field 2A.
W77-07659

THE GENERATION OF SYNTHETIC MONTHLY RUNOFF RECORDS FOR UNGAUGED BRITISH CATCHMENTS, Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-07661

MULTIDIMENSIONAL STATISTIC MODELLING OF HYDROLOGICAL PROCESSES ON THE BASIS OF STRUCTURAL ANALYSIS OF THE EMPIRICAL HYDROGRAPHS OF RUNOFF, Siberian Energy Inst., Irkutsk (USSR).
For primary bibliographic entry see Field 2A.
W77-07662

STOCHASTIC DIFFERENCE EQUATION MODELLING OF HYDROLOGICAL PROCESSES, Purdue Univ., Lafayette, Ind. School of Civil Engineering.
R. A. Rao, and R. L. Kashyap.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 140-150, 1974. 4 fig, 4 tab, 11 ref. OWRT B-025-IND(1). NSF GK18225, AFOSR 19-1776.

Descriptors: *Hydrologic systems, *Mathematical models, *Forecasting, *Algorithms, *Indiana, Mathematical studies, Mathematics, Stochastic processes, Statistical methods, Model studies, Analytical techniques, Streamflow, Flow, River flow, Hydrologic aspects, Hydrology.
Identifiers: *Wabash River(Ind), *White River(Ind), Daily flows.

Hydrological processes are modelled in the form of finite difference equations. The problem of parameter estimation by the method of moments, especially for systems of higher order, can be formidable both from the computational and analytical

points of view. In order to overcome this problem, a recursive system identification procedure, along with a prediction scheme, was proposed. The identification of the system parameters and the single step or multistep prediction of the variable of interest were performed simultaneously. Three aspects of hydrological interest were discussed by using an algorithm. These aspects are the prediction of daily flows, the modelling of the systems of different orders for simulating daily flows, and an analysis of the criterion to select the 'best' system model. The performances of systems of various orders were analyzed by using their error characteristics. The method analysis was illustrated by using data from two rivers in Indiana. (See also W77-06708) (Humphreys-ISWS)
W77-07663

STRUCTURAL RELATION BETWEEN PARAMETRIC AND STOCHASTIC HYDROLOGY MODELS, Pittsburgh Univ., Pa.
For primary bibliographic entry see Field 2A.
W77-07664

SIGNIFICANCE TESTS OF PERIODICITY IN HYDROLOGICAL TIME SERIES, Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-07665

A SIMPLE STOCHASTIC MODELLING OF HURST'S LAW, Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
P. E. O'Connell.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 169-187, 1974. 9 fig, 2 tab, 23 ref.

Descriptors: *Streamflow, *Hydraulics, *Model studies, *Mathematical models, Streams, Rivers, Reservoirs, Flow, Inflow, Stochastic processes, Monte Carlo method, Water resources, Synthetic hydrology, Hydrology.
Identifiers: *Hurst's law.

A stationary stochastic linear process was proposed which models Hurst's law successfully within asymptotically large time series. The model, a mixed, moving, average-autoregressive process belonging to the Brownian domain, incorporates two parameters which preserve estimates in generated sequences from a historic record of both h , the Hurst coefficient, and ρ sub 1, the first autocorrelation coefficient. For certain values of the parameters, the autocorrelation function of the model embraces a very large time span, thereby ensuring adequate fitting of low frequency effects in a historic record and their reproduction in a generated sequence. The simultaneous preservation of ρ sub 1 ensures satisfactory high frequency behavior. The elegant simplicity of the model should prove attractive to engineers wishing to preserve historic record estimates of both h and ρ sub 1 within synthetic sequences. (See also W77-06708) (Sims-ISWS)
W77-07666

IN HYDROLOGY H IS A HOUSEHOLD WORD, IBM Thomas J. Watson Research Center, Yorktown Heights, N. Y.
For primary bibliographic entry see Field 2A.
W77-07667

MATHEMATICAL MODELS RESULTING FROM STATISTICAL ANALYSIS OF THE MEAN MONTHLY FLOW, Ebasco Services, Inc. New York.
B. S. Brown.

In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 212-217, 1974. 5 fig, 3 tab, 8 ref.

Descriptors: *River flow, *Rivers, *Model studies, Mathematical models, Mathematical studies, Streamflow, Flow, Monthly, Discharge(Water), Curves, Frequency curves, Hydrology.
Identifiers: *Petawawa River(Canada).

The mean monthly flow frequencies were studied for the purpose of establishing mathematical models representing the series of mean monthly river discharges, comprised of the series of January discharges, February discharges, etc. The variance of these series is large for most months, particularly for autumn months, while the skewness also is large. The frequency functions which describe other hydrologic series well are only partially applicable to the mean monthly flow distribution. Other models were suggested, the Petawawa River (Canada) serving as an object for this study. (See also W77-06708) (Sims-ISWS)
W77-07669

FLOOD FREQUENCY STUDIES OF RIVERS IN THE FEDERAL REPUBLIC OF GERMANY, Technische Universität, Brunswick (West Germany). Leichtweiss Inst. for Water Research.
U. Maniak.

In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 221-225, 1974. 4 fig, 1 tab.

Descriptors: *Watersheds(Basins), *Runoff, *Model studies, Mathematical models, Precipitation(Atmospheric), Statistical methods, Flow, Foreign countries, Foreign research, Streamflow, Gaging stations, Stream gages, Analytical techniques, Hydrology.
Identifiers: *West Germany, Skewness.

The influence of the length of time series and of locally dependent statistical parameters was shown for 121 gauge stations of small watersheds in the Federal Republic of Germany. Investigations were based on the logarithmic Pearson type III distribution. (See also W77-06708) (Sims-ISWS)
W77-07670

STATISTICAL ANALYSIS APPLIED TO THE STUDY OF THE COMPONENTS OF A FLOOD WAVE, Institut de Meteorologie si Hidrologie, Bucharest (Romania).
V. Stancu, and C. Catana.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 253-265, 1974. 6 fig, 3 tab, 5 ref.

Descriptors: *Flood waves, *Rivers, *Watersheds(Basins), *Model studies, Mathematical models, Correlation analysis, Probability, Discharge(Water), Peak discharge, Flow, Streamflow, Stream gages, Analytical techniques, Foreign research, Foreign countries, Hydrology.
Identifiers: *Romania.

A method of determining the main characteristics of flood wave components at the outlet of a drainage system was presented. The method is based on the correlation existing between the volume and maximum flow of component waves over the different locations of a system. The unidimensional spread of the data rows for the stream and maximum flow are converted into normal distributions, and hence, the probabilities for a simultaneous occurrence of wave components at each confluence point are calculated. A further demonstration was made of the way to pass from

one confluence point to another with a final achievement in the form of an areal distribution, tabulation for the elements characteristic to the components over a whole basin, when the outlet flood waves have a given probability, defined by their volume or the high tide. Finally, a method of determining the statistical data of the main item rows of components within points with no direct measurements was presented. (See also W77-06708) (Sims-ISWS)
W77-07674

A MULTIVARIATE MATHEMATICAL MODEL OF MONTHLY RIVER FLOW,
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Science and Engineering.
S. Pinkayan, and R. Khaleel.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 279-288, 1974. 4 fig, 1 tab, 9 ref.

Descriptors: *River flow, *Rivers, *Monthly, *Model studies, Mathematical models, Time series analysis, Correlation analysis, Flow, Streamflow, Irrigation, Hydrology, Foreign research, Foreign countries.
Identifiers: *Thailand.

River flow data are often recorded at the site of water resource projects for a short period of time, while records are available for longer periods at other gaging stations. The purpose of this study is to find a mathematical model to represent a time series of monthly river flows at the project site, including the statistical parameters of flow at the gaging station of longer record. The model is composed of three components; namely, trend, periodic, and stochastic. The trend component was eliminated by adding irrigation diversion to measured flow and thereby obtaining the reconstructed virgin flow. The logarithm of virgin flow was then made stationary, or periodicity free, by fitting the periodic function of a 12-month period and its subharmonics. The techniques of correlogram and spectral analysis were used to detect the periods in the monthly means and to detect the standard deviations about the monthly values. The stationary stochastic series was found to fit well a linear autoregressive scheme of first order for two stations. (See also W77-06708) (Sims-ISWS)
W77-07675

FINDING REGULARITIES IN LONG-TERM STREAMFLOW FLUCTUATIONS BY ANALYSIS OF HYDROLOGICAL ENSEMBLES,
Akademiya Nauk SSSR, Moscow. Institut Vodnykh Problem.
S. N. Kritsky, and M. F. Menkel.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 299-304, 1974. 16 ref.

Descriptors: *Streamflow, *Runoff, *Fluctuations, *Model studies, Mathematical studies, Streamflow forecasting, Peak discharge, Discharge(Water), Rivers, Streams, Probability, Watersheds(Basins), Rainfall, Precipitation(Atmospheric), Maximum probable flood, Hydrology, Meteorology, Foreign research, Foreign countries.
Identifiers: *USSR.

Flow observations from each separate river basin are insufficient for the estimation of probability characteristics of runoff, especially in the evaluation of rare extremes. As it is not possible to increase the number of flow observations from each station, the only alternative is to attempt to increase the record length by a combined analysis of data from a set of river basins. The main difficulty lies in taking into account the non-uniformity of the material being jointly investigated. The report

contained an approach to the solution of this problem. (See also W77-06708) (Sims-ISWS)
W77-07676

TIME AND FREQUENCY-DOMAIN IDENTIFICATION OF A CASUAL BIVARIATE STOCHASTIC PROCESS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
C. C. Kisiel, and L. Duckstein.
In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 364-371, 1974. 4 fig, 1 tab, 5 ref. OWRT B-007-ARIZ(27).

Descriptors: *Streamflow, *Rivers, *Model studies, Mathematical models, Forecasting, Stochastic processes, Time series analysis, Flow, Regression analysis, Data processing, Hydrology.
Identifiers: *San Francisco River(NM).

Short-term forecasting of river flows requires specification of either a deterministic or a stochastic model. To ascertain the utility of stochastic models, a bivariate time series analysis of flows at two stations 12 miles apart on the San Francisco River, New Mexico, was performed. Use of multiple input-output pairs indicates that later or earlier flows introduce artificial noise into bivariate correlations and spectra such that either meaningful interpretation is obscured or loss of information occurs. Consideration of individual input-output pairs grouped into seasons, then of high, medium and low flows provides more insight into the nature of the nonlinear delays and extent of linear attenuation induced by the system. The coherences are strongest for the flood peaks and for the lower part of the recessions. The effects of sample size, sampling interval, and number of lags on system identification were also considered. The analysis leads to a series of bivariate time series models for forecasting downstream flows. This method was compared to predictions by regression so as to evaluate information loss and transferability. (See also W77-06708) (Sims-ISWS)
W77-07680

RUNOFF, EROSION, AND NUTRIENT MOVEMENT FROM INTERRILL AREAS,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2J.
W77-07766

REPRESENTATIVE AND EXPERIMENTAL BASINS - WHERE NEXT,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2A.
W77-07781

ASPECTS OF BANKFULL GEOMETRY IN A DISTRIBUTARY SYSTEM OF EASTERN AUSTRALIA,
Macquarie Univ., Ryde (Australia). School of Earth Sciences.
S. J. Riley.
Hydrological Sciences Bulletin, Vol. 21, No. 4, p 545-560, December 1976. 6 fig, 4 tab, 29 ref.

Descriptors: *Streams, *Cross-sections, *Channel morphology, *Energy loss, *Australia, Sediment load, Roughness(Hydraulic), Measurement, Foreign countries, Foreign research.
Identifiers: *Factor analysis.

The bankfull cross sectional geometry of a stream was described by 18 variables, and it was pointed out that each of these variables can be used to discriminate among stream sites. These variables were reduced to four factors: (1) an index of channel capacity and efficiency, (2) an index of cross sectional shape and mode of energy expenditure, (3) an index of bottom width and sediment load,

and (4) an index of profile roughness. These four factors were shown to explain 84% of the correlation matrix variance. (Bhowmik-ISWS)
W77-07782

2F. Groundwater

METAMORPHIC REACTIONS IN FLYSCH ROCKS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 2K.
W77-07609

14C EVIDENCE FOR THE ORIGIN OF ARID REGION GROUNDWATER, NORTHEASTERN PROVINCE, KENYA,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 7B.
W77-07611

USE OF CROSS-CORRELATION TECHNIQUES FOR DETERMINING THE RELATIONSHIP BETWEEN GROUNDWATER LEVELS AND SOURCES IN THE NILE DELTA AREA,
M. G. Elgizawi.

In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 319-325, 1974. 6 fig, 3 tab.

Descriptors: *Rivers, *Aquifers, *Water levels, *Model studies, Mathematical models, Hydrographs, Correlation analysis, Stochastic processes, Groundwater, Groundwater recharge, Water table, Surface-groundwater relationships, Hydrology, Foreign countries, Foreign research, Deltas.
Identifiers: *Nile River(Egypt).

The movement of groundwater in the River Nile delta is affected by fluctuations in the level of the river, which is the main feeder of the delta's aquifer. The relationship between the river and the adjacent aquifer water levels for any time lag was studied by the use of the cross-correlation technique. The relationship was defined, and then it was used to predict the groundwater levels and flow from the aquifer. (See also W77-06708) (Sims-ISWS)
W77-07679

DETERMINATION OF SALT-WATER INTERFACE BY ELECTRIC RESISTIVITY DEPTH SOUNDINGS,
Tel Aviv Univ. (Israel). Dept. of Environmental Sciences.
A. Ginzburg, and A. Levanon.
Hydrological Sciences Bulletin, Vol. 21, No. 4, p 561-568, December 1976. 6 fig, 6 ref.

Descriptors: *Aquifers, *Saline water intrusion, *Saline water-freshwater interfaces, Observation wells, Geophysics, Hydrogeology, Groundwater, Monitoring, Mapping, Foreign research.
Identifiers: *Electrical resistivity, *Geophysical methods, *Israel, Coastal aquifers.

Vertical electrical resistivity soundings were measured near hydrological observation wells in order to ascertain whether geophysical means could be used to map saline water intrusion into a freshwater aquifer in Israel. The soundings showed that the low resistivity layers associated with the salt water are readily discernible. The technique was applied to the entire coastal belt and resulted in a detailed study of the saline water body and its extent. Measurements were repeated six years later, and good agreement between the two sets of measurements was noted. This technique, therefore, is judged to be an accurate tool for the mapping of

Field 2—WATER CYCLE

Group 2F—Groundwater

salt water intrusion in freshwater aquifers.
(Adams-ISWS)
W77-07783

THE USE OF SKYLAB AND LANDSAT IN A GEOHYDROLOGICAL STUDY OF THE PALEOZOIC SECTION, WEST-CENTRAL BIGHORN MOUNTAINS, WYOMING.
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 7B.
W77-08063

2G. Water In Soils

HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME 4, (ANALYTICAL METHODS FOR SEWAGE SLUDGE ANALYSIS).
Toronto Univ. (Ontario). Inst. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W77-07614

EXAMINATION OF SEWAGE SLUDGE FOR ENTEROVIRUSES, VOLUME 2,
Ontario Ministry of Health, Toronto. Lab. Services Branch.
For primary bibliographic entry see Field 5B.
W77-07615

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR LAKE DRAINAGE BASIN, APPENDIX I-12,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
Prepared for the Oregon State Water Resources Board, (Salem), 1969. 79 p, 2 fig, 10 tab, 2 map.

Descriptors: Soils, *Soil surveys, *Soil profiles, Soil properties, *Soil types, *Infiltration, *Infiltration rates, *Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *Malheur Lake Drainage Basin(OR), *Available waterholding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented on 6.3 million acres of the Malheur Lake Basin in southeastern Oregon. The Malheur Basin includes most of Harney County and parts of Lake, Malheur, Grant and Cook Counties. The report is based on information gathered by the National Cooperative Soil Survey program, with soil interpretations relating to water use and management. Major physiographic areas covered in the report are basins and valleys, grass-shrub covered lava plains and plateaus, and forested uplands. Poor drainage and alkali conditions are found primarily in Harney and Lake Counties, in the Guano, Catlow, and Silvies sub-basins. Guidelines are given for interpreting soils for irrigation suitability, providing limits for classes of slight, moderate, severe, and very severe limitations. Fifteen of the 48 soils analyzed were unsuitable for irrigation due to shallow, stony soils or steep slopes. Those soils subject to flooding and ponding are given, as well as runoff potential for all soils. Soils are analyzed according to runoff, infiltration, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard and temperature limitations. Reconnaissance classification units and land units identified in the Basin and shown on the soil map are described. (Gentry-NC)
W77-07617

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, GOOSE AND SUMMER LAKES DRAINAGE BASIN, APPENDIX I-13,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
B. B. Lovell, J. A. Norgren, G. H. Simonson, M. G. Lindsay, and D. Anderson.
Prepared for the Oregon State Water Resources Board, (Salem), 1969. 94 p, 2 fig, 10 tab, 2 map.

Descriptors: Soils, *Soil surveys, *Soil profiles, Soil properties, *Soil types, Infiltration, *Infiltration rates, Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *Goose Lake Drainage Basin(OR), *Summer Lake Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 5 million acres of the Goose and Summer Lakes Drainage Basin in south-central Oregon, 1.5 million acres of which are suited for crops or improved pasture. The basin includes most of Lake County and parts of Harney, Klamath and Deschutes Counties. The basin consists of a varied terrain of large fault-block basins, upthrust dissected highlands and lava tablelands. Physiographic areas include lake basins and alluvial bottomlands, grass-shrub covered lava plains and plains, pumice-mantled high lava plains and forested mountain uplands. Most poorly drained and alkali soils occur in Lake County, mostly in the Summer Lake sub-basin. Guidelines are presented for interpreting soils into irrigation suitability groups, with 12 soil/land characteristics rated as to excellent, moderate, severe and very severe limitations. Forty-seven of the soils analyzed are poorly suited or unsuited for irrigation because of shallow soils, stony or coarsely textured soils, and/or steep slopes. A total of 1,557,800 acres are suited for irrigation. Soils are studied according to runoff, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard and temperature limitations. Soils are interpreted with regard to water use and management, based on information gathered by the National Cooperative Soil Survey program in Oregon. Descriptions are given of soil series and land types found in the basin. (Gentry-NC)
W77-07618

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, KLAMATH DRAINAGE BASIN, APPENDIX I-14,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
J. S. Cahoon, and G. H. Simonson.
Prepared for the Oregon State Water Resources Board, (Salem), 1969. 78 p, 35 fig, 18 tab.

Descriptors: Soils, *Soil surveys, *Soil profiles, Soil properties, *Soil types, Infiltration, *Infiltration rates, Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *Klamath Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 3.5 million acres of the Klamath Basin, of which more than 900,000 acres are suited for crop and improved pasture production. The basin is composed of the watersheds of the Klamath, Williamson, Sprague and Lost Rivers located in south-central Oregon. The basin is divided into three physiographic divisions including the Cascade Mountains, the Basin and Range section, and the

lava plateaus. Soils are interpreted with regard to water use and management, based on information gathered by the National Cooperative Soil Survey program in Oregon. Poorly drained soils are Algoma, Chinchallo, Ck, Kirk, Moyina, Tulana, and Yamsay. The Williamson River sub-basin especially has drainage problems. Guidelines are given for interpreting soils into irrigation suitability groups, with 12 soil/land characteristics rated. Soils subject to seasonal flooding are Algoma, Chinchallo, Ck, Ho, Kirk, Klamath, Moyina, Ontko, Pit, Tulana, Yamsay and Yonna. Many of the soils in the Klamath Basin have become alkaline as a result of wetness. Reclamation potential for alkaline soils is discussed. Soils are analyzed according to runoff, infiltration, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, and alkali status. Descriptions are given of the soil series, land types, and mapping units in the basin. (Gentry-NC)
W77-07619

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, ROGUE DRAINAGE BASIN, APPENDIX I-15,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
W. E. Power, and G. H. Simonson.
Prepared for the Oregon State Water Resources Board, (Salem), 1969. 69 p, 3 fig, 12 tab, 2 map.

Descriptors: Soil, *Soil surveys, *Soil profiles, *Soil properties, *Soil types, Infiltration, rates, Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *Rogue Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 2,745,400 acres of the Rogue Drainage Basin in southwest Oregon, 400,000 acres of which are suited for crops or improved pasture. The basin lies mainly in Jackson and Josephine Counties. The terrain is predominantly forested and mountainous with Cascade Mountains running north-south (essentially a rolling plateau of volcanic material) and the Klamath Mountains extending westerly to the Pacific Ocean. Physiographic categories studied include stream bottomlands, low foothills and valley terraces, Klamath mountains, Cascade slopes and Cascade Mountains. Sub-basins studied are the Upper Rogue, Little Butte Creek, Bear Creek, Applegate, Middle Rogue, Illinois and Lower Rogue. Areas subject to impeded drainage, irrigation suitability, frequency of flooding and hydrologic soil groups are discussed. Soils are analyzed according to runoff, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, temperature limitations and drain field limitations. Soils are interpreted with regard to water use and management based on information collected in the National Cooperative Soil Survey program in Oregon. Descriptions are given of the soil series and land types found in the basin and shown on the soil map. (Gentry-NC)
W77-07620

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMPQUA DRAINAGE BASIN, APPENDIX I-16,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
J. A. Pomeroy, R. C. Paeth, E. G. Knox, and G. H. Simonson.
Prepared for the Oregon State Water Resources Board, (Salem), 1969. 77 p, 1 fig, 13 tab, 2 map.

Descriptors: Soils, *Soil surveys, *Soil profiles, Soil properties, *Soil types, Infiltration, *Infiltration rates, Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *Umpqua Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 1,232,000 acres of the Umpqua Basin in western Oregon, about one third of the total drainage basin. The climates of the basin are grouped into coastal, intermountain lowlands and Cascade Mountain subdivisions with precipitation determined by elevation and proximity to the Pacific Ocean. The Coast Range lies in the western part, the Klamath Mountains in the southern portion, and the Cascade Mountains along the eastern fringe. The basin is covered with forest except where cleared for agriculture or grazing. About 275,000 acres are suitable for irrigation. Twelve soil/land characteristics are rated for irrigation suitability—excellent, good/fair, poor, very poor/nonirrigable. Soils subject to seasonal flooding are Brenner, Camas, Cloquato, Coquille, Gardiner, Nehalem, Nestucca and Newberg. Approximately 85,000 acres are subject to seasonal and occasional flooding. Soils are analyzed in terms of runoff, infiltration, permeability, available water-holding capacity (AWHC), effective root zone, shrink-swell potential, workability, and erosion hazard. A total of 113 soil series were taken. Soils are interpreted with regard to water use and management, based on information gathered by the National Cooperative Soil Survey program in Oregon. Soil series and land types found in the basin and shown on the soil map are described. (Gentry-NC)
 W77-07621

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, NORTH, MID-, AND SOUTH COAST DRAINAGE BASINS, APPENDIX I-17, AND 18.
 Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
 B. R. Thomas, and G. H. Simonson.
 Prepared for the Oregon State Water Resources Board, (Salem), 1969, 83 p, 4 fig, 13 tab, 2 map.

Descriptors: Soils, *Soil survey, *Soil profiles, Soil properties, *Soil types, Infiltration, *Infiltration rates, Runoff, *Irrigation, *Drainage, *Oregon, Soil texture, Soil moisture, Permeability, Water management(Applied), Root zone.
Identifiers: *North Coast Drainage Basin(OR), *Mid-Coast Drainage Basin(OR), *South Coast Drainage Basin(OR), *Available water-holding capacity(AWHC), *Shrink-swell potential, Erosion hazard, Temperature limitation.

A general soil map and soil descriptions, interpretations and acreage figures are presented for 588,400 acres of the North Coast, Mid-Coast and South Coast Drainage Basins. Steep forested uplands comprise nearly 90% of the total 5.15 million acres in the Coast basins. The Coast Range Mountains along the North and Mid-Coast basins are composed mostly of Tertiary marine sedimentary formations, basalt flows and basic igneous intrusions. The Klamath and Coastal Mountains are deformed, intruded and highly dissected. Soils are grouped and described according to their occurrence in estuary tidelands, stream flood plains, alluvial fans, dune lands, marine terraces, stream terraces and uplands. Soils are categorized in groups relating to adequate drainage, suitability for irrigation, possibility of flooding, and hydrologic soil types. Soils are analyzed in terms of runoff, permeability, available water holding capacity (AWHC), effective root zone, shrink-swell potential, workability, erosion hazard, and major soil limitations. Interpretations of soils are

related to water use and management based on information collected by the National Cooperative Soil Survey program in Oregon. Descriptions are given of the soil series, land types and mapping units used on the soil map. (Gentry-NC)
 W77-07622

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. IRRIGATION AND FOOD PRODUCTS PROJECTIONS, APPENDIX II.
 Oregon State Univ., Corvallis. Cooperative Extension Service; and Oregon State Univ., Corvallis. School of Agriculture; and Oregon State Univ., Corvallis. Agricultural Experiment Station.
 For primary bibliographic entry see Field 6D.
 W77-07623

SIMULATION OF DAILY RAINFALL SERIES USING MARKOV CHAIN MODELS.
 Institute for Water Resources, Belgrade (Yugoslavia).
 For primary bibliographic entry see Field 2A.
 W77-07660

A STATISTICAL FILTRATION MODEL FOR THE INSEEPAGE OF MELT WATER INTO FROZEN GROUND.
 Akademiya Nauk SSSR, Moscow. Institut Vodykh Problem.
 A. B. Kasansky.
 In: Mathematical Models in Hydrology, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 241-245, 1974. 4 ref.

Descriptors: *Infiltration, *Porous media, *Model studies, *Mathematical models, Pores, Pore water, Soil water, Soil water movement, *Seepage, *Melt water, Melting, Snow, Snow cover, Hydraulic conductivity, Equations, Hydrodynamics, Hydrology, Foreign research.

The processes of filtration transfer of impurities into the so-called 'active' upper ground layer where the filtration circulation of water is especially intensive were considered. A general theory has been proposed previously to explain these processes on the basis of a statistical model developed for filtration flow in a porous medium; the main attention was focused on the development and the application of the methods of statistical hydrodynamics. An entirely new approach underlies this theory for describing the averaged regime of filtration flow, as well as for describing the transfer of heat and impurities. This approach takes into account the need to consider the microstructure of porous media in deriving the averaged equations, and consequently, it is based on a consideration of individual microflows in porous media. In accordance with such an approach, the very equations that describe the averaged regime of the filtration processes are to be derived from the elementary equations of dynamics, diffusion, and heat conductivity that describe these processes inside the individual pore channels. (See also W77-06708) (Sims-ISWS)
 W77-07672

HETEROTROPHIC NITRIFICATION IN SOILS AND AQUATIC ENVIRONMENTS, (IN RUSSIAN).
 For primary bibliographic entry see Field 5C.
 W77-07754

TRANSPORT OF REACTIVE SOLUTES THROUGH MULTILAYERED SOILS.
 Florida Univ., Gainesville. Dept. of Soil Science.
 H. M. Selim, J. M. Davidson, and P. S. C. Rao.
 Soil Science Society of America Journal, Vol. 41, No. 1, p 3-10, January-February 1977. 15 fig, 2 tab, 18 ref. EPA R-803607.

Descriptors: *Soil water movement, *Solute, *Adsorption, Soil water, Saturated flow, Unsaturated flow, Soils, Sands, Loam, Laboratory tests, Mathematical models, Dispersion, Effluents, 2,4-D, Sorption, Agriculture, Soil science, Path of pollutants.
Identifiers: *Solute transport, Soil layers, Multilayered soils, Nonhomogeneous soils.

Solute transport through saturated and unsaturated multilayered soils was studied using laboratory experiments and finite difference approximations of the solute transport equation. Soil water and physical characteristics as well as solute sorption properties were measured and/or calculated for each soil layer. Linear and nonlinear equilibrium and kinetic adsorption processes were used to predict adsorption in each layer. Water flux was assumed constant for water-saturated and unsaturated layered soil profiles. For all adsorption processes considered, the calculated results showed that the order in which the soil layers were stratified in a water-saturated profile did not influence the effluent solute concentration distribution. For unsaturated layered soil profiles, the results showed that effluent solute distributions can be predicted with an average water content within individual soil layers. Experimental results from the miscible displacement of 36C1 and 14C-labeled-2,4-D ((2,4-dichlorophenoxy) acetic acid), through a two-layered soil column supported the calculated results. (Sims-ISWS)
 W77-07758

SOLUTE MOVEMENT IN A FIELD SOIL.
 New Mexico State Univ., Las Cruces. Dept. of Agronomy.
 R. M. Van De Pol, P. J. Wierenga, and D. R. Nielsen.
 Soil Science Society of America Journal, Vol. 41, No. 1, p 10-13, January-February 1977. 5 fig, 8 ref. EPA 13030GLM.

Descriptors: *Soil water movement, *Solute, *Subsurface flow, On-site investigations, Soils, Porous media, Infiltration, Adsorption, Leaching, Dispersion, Variability, Spatial distribution, Tracers, Tritium, Chlorides, Pore water, Soil water, Agriculture, Soil science, Path of pollutants.
Identifiers: *Solute transport.

Solute and water movement was studied under steady-state flow conditions in a field soil consisting of 70 cm of clay to silty clay over a medium sand. A steady-state water flow condition was maintained by applying irrigation water at a constant flux of 2 cm per day. During the steady-state conditions, some of the water leached into the plot was labelled with chloride and tritium. The positions of the chloride and tritium as functions of soil depth and time were measured by extracting samples of the soil solution with soil suction probes. Extremes in solute displacement occurred at equal and different depths within the plot. An analysis of these measurements indicated that observations of the pore water velocity and the apparent diffusion coefficient were log normally distributed. Twenty-four soil suction probes, used to identify the rate at which a solute was displaced in the soil, will yield an estimate of the mean pore water velocity of this soil within a range of approximately plus or minus 25% of its true value, providing that the effects of potential solute-solute interactions are taken into account. (Sims-ISWS)
 W77-07759

FRITTED GLASS BEAD MATERIALS AS TENSIO-METERS AND TENSION PLATES.
 Newfoundland Forest Research Centre, St. John's.
 T. L. Chow.
 Soil Science Society of America Journal, Vol. 41, No. 1, p 19-22, January-February 1977. 1 fig, 3 tab, 5 ref.

Field 2—WATER CYCLE

Group 2G—Water In Soils

Descriptors: *Tensiometers, *Moisture tension, *Instrumentation, Materials, Porous media, Particle size, Hydraulic conductivity, Saturated flow, Laboratory tests, Materials testing, Materials engineering, Soil water, Soil science.

Identifiers: *Fritted glass bead material, Glass, Fritted glass, Porous cups, Air-entry value.

A maximum temperature of 655 C, which was reached in six steps with approximately 100 C/step/hour for 90 min, was used to frit glass beads. Tensiometer or tension plate with desired dimension and operational characteristics can be constructed from the product. Uniformity tests on the product indicate negligible horizontal temperature variations during the fritting process, and slow heat dissipation during the cooling phase tends to limit its thickness. Tests on the particle size distributions suggest that glass beads graded to very narrow distribution are required to produce fritted material with both the maximum saturated hydraulic conductivity and maximum air-entry value. (Sims-ISWS)

W77-07760

MODEL OF SALT FLOW IN SOIL WITH A SOURCE-SINK TERM.

Utah State Univ., Logan. Dept. of Soil Science. D. Melamed, R. J. Hanks, and L. S. Willardson. Soil Science Society of America Journal, Vol. 41, No. 1, p 29-33, January-February 1977. 4 fig, 12 ref. EPA 9801040.

Descriptors: *Saline soils, *Irrigation, *Salts, *Model studies, Mathematical models, Laboratory tests, On-site investigations, Soil properties, Salinity, Electrical conductance, Conductivity, Soil chemical properties, Effluents, Chemical precipitation, Leaching, Soil science, Path of pollutants.

Identifiers: *Soil salt movement, Source-sink terms.

Irrigation management practices require a knowledge of the salinity in the root zone. Models which simulate the simultaneous movement of water and salts but ignore the buffering property of the soil fail to predict the root zone salinity distribution in many field situations. A model was developed that takes into consideration source and sink processes. It was tested under laboratory and field situations. In determining a 'source-sink' term to be included in the model, it was assumed that precipitation and dissolution were the most important source processes and that the rate of the processes was a function of the surrounding concentration. The parameters for the 'sink-source' term for soil columns were determined from effluent data and were found suitable for predicting the salinity of the entire soil column. Under field conditions, individual parameters for each layer were needed for good prediction. (Sims-ISWS)

W77-07761

SOIL FORMATION ON LOESS IN SOUTHWESTERN INDIANA: I. LOESS STRATIGRAPHY AND SOIL MORPHOLOGY. Purdue Univ., Lafayette, Ind. Dept. of Agronomy. P. W. Harlan, and D. P. Franzmeier. Soil Science Society of America Journal, Vol. 41, No. 1, p 93-98, January-February 1977. 5 fig, 2 tab, 15 ref.

Descriptors: *Soil formation, *Loess, *Indiana, Stratigraphy, Geomorphology, Paleosols, Residual soils, Soil classification, Weathering, Particle size, Soil horizons, On-site investigations, Cores, Sampling, Moisture content, Perched water, Depth.

Identifiers: Frigipan, Soil morphology, Parent material.

Thin loess deposits and underlying Sangamon paleosols were studied and then were related to modern soil development. Ninety-one sites were sampled along four traverses extending 60-80 km

eastward from the lower Wabash River, the main loess source. The ground soils, located mostly on primary divides, have a parent material sequence of silty loess (Peoria), sandy loess, upper part of Sangamon paleosol, and lower part of Sangamon paleosol. The paleosols developed in till or outwash of Illinoian age or in residuum of Pennsylvanian or Mississippian age. Soil development increases with increasing distance from the loess source. Thick loess (greater than 2 m) soils have an A-B2t-C horizon sequence, whereas the thinner loess 81-2 m soils have an A-B2t-(A'2)-Bx horizon sequence. Soils with less than 0.75 to 1 m of loess have B2t horizons in both loess and residuum and usually do not have fragipans. Fragipans tend to be associated with sandy loess, but they usually do not coincide with it. Fragipans may be just above the sandy loess, coincident with it, or in some combination of sandy loess and adjacent parent materials. It is believed that soil moisture relations influenced by the sandy loess, or by the underlying paleosols, or by both, promote fragipan development. (See also W77-07763) (Visocky-ISWS)

W77-07762

SOIL FORMATION ON LOESS IN SOUTHWESTERN INDIANA: II. DISTRIBUTION OF CLAY AND FREE OXIDES AND FRAGIPAN FORMATION. Purdue Univ., Lafayette, Ind. Dept. of Agronomy. P. W. Harlan, D. P. Franzmeier, and C. B. Roth. Soil Science Society of America Journal, Vol. 41, No. 1, p 99-103, January-February 1977. 4 fig, 1 tab, 10 ref.

Descriptors: *Soil formation, *Loess, *Indiana, Soil profiles, Soil surveys, Drainage, Clays, Oxides, Iron oxides, Aluminum, Manganese, Silica, On-site investigations, Cores, Sampling, Distribution.

Identifiers: Frigipan, Catenas.

Fourteen soil profiles from southwestern Indiana were studied to determine the effects of loess thickness and natural soil drainage on the profile distribution of clay and free oxides (CBD-extractable) of Fe, Al, Mn, and Si. In all soils, Fe and Al curves follow the clay curve, suggesting that the oxides are adsorbed on clays and move with them. Natural soil drainage has little effect on profile distribution of clay, Si or Fe. Free Al2O3 contents increase slightly with poorer drainage. With thinning loess, clay and free Fe2O3 distribution changes little, free Al2O3 contents increase slightly, free MnO2 curves have more pronounced minima and maxima, and free SiO2 increases significantly in fragipan horizons. It was proposed that free silica moves down the profile in solution and precipitates, possibly with aluminum hydrous oxides on clays. The resulting silica or aluminous silicate binds particles together to form the hard, brittle soil material of fragipans. (See also W77-07762) (Visocky-ISWS)

W77-07763

GULLY WALL STABILITY IN LOESS-DERIVED ALLUVIUM. Agricultural Research Service, Columbia, Mo. For primary bibliographic entry see Field 4D.

W77-07764

HYDROLOGIC DIFFERENCES BETWEEN SELECTED FORESTED AND AGRICULTURAL SOILS IN HAWAII. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif. H. B. Wood. Soil Science Society of America Journal, Vol. 41, No. 1, p 132-136, January-February 1977. 3 fig, 3 tab, 15 ref.

Descriptors: *Land use, *Hawaii, *Forest soils, Soil types, Drying, Infiltration, Soil investigations, Soil aggregates, Bulk density, Agriculture.

Identifiers: Oxisols, Ultisols, Inceptisols, Histosols.

Comparisons of hydrologic characteristics of soil under different land uses were made at 15 sites on the islands of Hawaii, Maui, and Kauai. A site consisted of at least 2 adjacent but different land uses on the same soil series. One land use at a site was always an ungrazed forest; the other sites were planted either to sugarcane or pineapple, or used as pasture. Infiltration rates on 14 of the 15 sites were found to be higher under forest cover than under agriculture uses. Mean weight diameters of the surface soil aggregates were larger for forested soils than for soils planted to sugarcane or pineapple. Aggregate size also varied with soil order and soil moisture content at time of testing. Lower bulk densities and greater porosities were found in forest-covered soils than in the non-forested soils. (Roberts-ISWS)

W77-07765

PREDICTIONS OF THE SOIL WATER FLUX BASED UPON FIELD-MEASURED SOIL-WATER PROPERTIES.

Arizona Univ., Tucson. A. W. Warrick, G. J. Mullen, and D. R. Nielsen. Soil Science Society of America Journal, Vol. 41, No. 1, p 14-19, January-February 1977. 5 fig, 4 tab, 12 ref.

Descriptors: *Soil water movement, *Variability, *Soil properties, Soil water, On-site investigations, Sampling, Hydraulic conductivity, Mathematical models, Spatial distribution, Moisture content, Soils, Clay loam, Monte Carlo method, Infiltration, Soil science.

Identifiers: *Soil water flux, Panoche clay loam.

Predictions of soil water flux are made taking into account spatial variability of the soil water parameters. A conductivity of the form $K = K_{sub 0} \exp(\alpha(\theta - \theta_0))$ is utilized where θ is the volumetric water content with $K_{sub 0}$ and θ_0 the values of hydraulic conductivity and water content for steady-state intake from water ponded on the soil surface. The value of α is an empirical constant for each site and for each depth. Monte Carlo simulations were used to simulate the flux distribution from the simplified drainage equation $J_{sub L} = K_{sub 0} / (1 + \alpha K_{sub 0} L)$. The flux of $J_{sub L}$ is a random output dependent upon the stochastic nature of $K_{sub 0}$ and α . Log-normal distributions of $K_{sub 0}$ and α are chosen from field data published for Panoche soil. Output of $J_{sub L}$ is approximately log-normal for all times studied. The mean value of $J_{sub L}$ is larger than the flux calculated using the average $K_{sub 0}$ and α values in the above equation. Sample numbers necessary to estimate the means of the flux at $t = 0, 1$, and 10 days were plotted. For $t = 0$, samples of 1,000, 100, and 50 result in estimates of $J_{sub L}$ within 16, 50, and 60% of the true mean 95% of the time. For $t = 1$ and 10 days similar figures for samples of 1,000, 100, and 50 are 4, 14, and 20%. Values of water content stored in the profile using the above equations also were examined as a random function. Unlike the flux values, the range in values stays about the same for at least 20 days. The research points out a need for meaningful methods for sample stratification in order to reduce variances. (Sims-ISWS)

W77-07772

ESTABLISHING SOIL ELECTRICAL CONDUCTIVITY-SALINITY CALIBRATIONS USING FOUR-ELECTRODE CELLS CONTAINING UNDISTURBED SOIL CORES. Agricultural Research Service, Riverside, Calif. Salinity Lab. J. D. Rhoades, M. T. Kaddah, A. D. Halvorson, and R. J. Prather. Soil Science, Vol. 123, No. 3, p 137-141, March 1977. 4 fig, 2 tab, 7 ref.

Descriptors: *Calibrations, *Conductivity, *Soils, *Salinity, *Electrical conductance, Physical properties, Resistivity, Electrodes, Saline soils, Soil

types, Soil analysis, Soil chemistry, Instrumentation, Soil moisture, Analytical techniques, Measurement, Pollutant identification.

Identifiers: *Soil electrical conductivity, *Conductivity-salinity calibrations, *Four-electrode cells, Soil cores, Wenner array method, Soil conductivity, Soil salinity calibration, Conductivity method, Soil core sampler, Field salinity, Sandy loam soils, Clay loam soils.

A simpler and more accurate method than previously used methods for calibrating soil salinity against soil electrical conductivity (EC sub a) was presented. Results were given which show that these calibrations are applicable to the Wenner array method of field EC sub a determinations. (Henley-ISWS)
W77-07776

COMPARISONS OF TWO MODELS FOR PREDICTING THE RELATIVE HYDRAULIC CONDUCTIVITY OF SALT-AFFECTED SWELLING SOILS.
Khartoum Univ. (Sudan). Dept. of Biochemistry and Soil Science.
M. A. Mustafa, and K. S. Hamid.
Soil Science, Vol. 123, No. 3, p 149-154, March 1977. 3 fig, 3 tab, 8 ref.

Descriptors: *Hydraulic conductivity, *Model studies, *Conductivity, *Soil physical properties, *Saline soils, Mathematics, Analytical techniques, Properties, Hydrology, Land reclamation, Soil chemical properties, Soil properties, Salinity, Soil types, Irrigation effects, Soil analysis, Foreign countries.
Identifiers: *Swelling soils, *Sudan, Salt-affected soils, Farag soil, Drushab soil, Interlayer swelling, Macroscopic swelling.

Macroscopic swelling (MS) of samples from two montmorillonitic soils of the Sudan increased as the exchangeable sodium percentage (ESP) increased and as the electrolyte concentration (C) of mixed-salt solutions decreased. Threshold ESP values existed with significant swelling occurring beyond such threshold levels. Macroscopic swelling accounted for 86 and 71% (r sub .001 = 0.62) of the variability of the relative hydraulic conductivity (RHC) of the two soils, respectively. Macroscopic swelling data qualitatively fitted McNeal's (1968) demixed-ion model, especially beyond the threshold ESP values. The fit was essentially quantitative for soils or ESP less than 50. Generally, deviations of theoretical interlayer swelling values from experimental MS values increased with ESP, with maximum theoretical values being 3 to 15 times experimental values. Interlayer swelling values were found to account for about 98% (r sub .001 = 0.742) of the variability in MS values for the two soils, and accounted for 87 and 75% (r sub .001 = 0.62) of the variability in RHC of two soils, respectively. The agreement between predicted and experimental RHC was fairly good for solutions of SAR equal to or greater than 50, but poorer for lower SAR values. The Lagerwerff (1969) mixed-ion model failed to predict MS both qualitatively and quantitatively. However, agreement between calculated and experimental RHC was found to be fairly good, even for this model. (Henley-ISWS)
W77-07777

THE USE OF LYSIMETERS IN THE HYDROLOGICAL INVESTIGATION OF THE UNSATURATED ZONE.
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 2D.
W77-07780

NITRATES IN SOME SOIL-WATER SYSTEMS IN QUEBEC, (IN FRENCH).
For primary bibliographic entry see Field 5B.
W77-07858

NITRIFICATION IN SOIL TREATED WITH DOMESTIC AND INDUSTRIAL SEWAGE SLUDGE.
Georgia Univ., Experiment. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-07862

EFFECTS OF TRACE ELEMENTS ON NITROGEN MINERALIZATION IN SOILS.
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W77-07864

APPLICATION OF SEWAGE SLUDGE TO CROPLAND.
For primary bibliographic entry see Field 5E.
W77-07869

ORGANIC MATTER AND HEAVY METAL UPTAKE.
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-07870

A TECHNIQUE TO INDEX SOIL PORES AND AGGREGATES LARGER THAN 20 MICROMETERS.
Agricultural Research Service, Salinas, Calif.
D. E. Wilkins, W. F. Buchele, and W. G. Lovely.
Soil Science Society of America Journal, Vol. 41, No. 1, p 139-140, January-February 1977. 1 fig, 9 ref.

Descriptors: *Indexing, *Soil structure, *Technology, Soil science, Pore pressure, Porosity, Methodology, Aggregates, Fluorescence, Analytical techniques, Photography, Pores.
Identifiers: *Soil pores, Pore orientation, Aggregate orientation, Fluorescent polyester resin, Flying spot particle analyzer, Nonswelling soils, Black light.

A laboratory technique was developed to measure soil pore size, soil aggregate size, and orientation of soil pores and soil aggregates. The technique consists of fixing soil samples with a fluorescent polyester resin, sectioning the soil samples, and taking a photograph under black light. The black light provides sharp contrast between pores and soil aggregates. The photographs were scanned with a Flying Spot Particle Analyzer (FSPA). From the FSPA scanning information, means, variances of soil aggregate size, soil pore size, and apparent soil porosity were calculated. The described technique is limited to nonswelling soils with pore and aggregate intercepts less than 20 micrometers. (Roberts-ISWS)
W77-08059

URBAN LAND USE: REMOTE SENSING OF GROUNDWATER PERMEABILITY.
California Univ., Santa Barbara. Geography Remote Sensing Unit.
For primary bibliographic entry see Field 7B.
W77-08065

MICROWAVE REMOTE SENSING OF SOIL MOISTURE.
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 7B.
W77-08066

SOIL MOISTURE DETECTION FROM SKYLAB.
Kansas Univ., Lawrence.
For primary bibliographic entry see Field 7B.
W77-08067

THE CORRELATION OF SKYLAB L-BAND BRIGHTNESS TEMPERATURES WITH ANTECEDENT PRECIPITATION.
Oklahoma Univ., Norman.
For primary bibliographic entry see Field 7B.
W77-08068

EVALUATION OF THERMAL X/5-DETECTOR SKYLAB S-192 DATA FOR ESTIMATING EVAPOTRANSPIRATION AND THERMAL PROPERTIES OF SOILS FOR IRRIGATION MANAGEMENT.
South Dakota State Univ., Brookings. Remote Sensing Institute.
For primary bibliographic entry see Field 7B.
W77-08079

2H. Lakes

CYCLING OF DISSOLVED ORGANIC PHOSPHORUS COMPOUNDS IN NATURAL WATERS.
Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5C.
W77-07608

APPLICATION OF STOCHASTIC HYDROLOGICAL MODELS IN THE DESIGN OF LAKE LEVEL CONTROL.
Technical Univ. of Budapest (Hungary).
For primary bibliographic entry see Field 4A.
W77-07681

VERTICAL MIXING MECHANISMS AND THEIR EFFECTS ON PRIMARY PRODUCTION OF PHYTOPLANKTON.
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 5C.
W77-07733

THE SCALING OF VELOCITY FLUCTUATIONS IN THE SURFACE MIXED LAYER.
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 2L.
W77-07768

EVALUATION OF POTENTIAL USE OF VEGETATION FOR EROSION ABATEMENT ALONG THE GREAT LAKES SHORELINE.
Dames and Moore, Cincinnati, Ohio.
For primary bibliographic entry see Field 4D.
W77-07788

CLASTIC SEDIMENTATION IN A MODERN ALPINE LAKE.
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W77-07791

STUDIES OF THE BENTHIC ENVIRONMENT OF TWIN LAKES.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 5C.
W77-07806

FEEDING OF FORAGE FISH IN TURBID KANSAS RESERVOIRS.
Kansas Univ., Lawrence. Dept. of Systematics and Ecology.
W. J. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 286.
Price codes: A02 in paper copy, A01 in microfiche.
Kansas Water Resources Research Institute, Lawrence, KWRRI Contribution No. 187.

Field 2—WATER CYCLE

Group 2H—Lakes

Completion Report, February 1977. 17 p. 8 fig. 12 ref. OWRT A-061-KAN(1), 14-31-0001-3816.

Descriptors: *Turbidity, *Food chains, Zooplankton, *Kansas, *Reservoirs, Lakes, *Sunfishes, *Fish diets, Fish food organisms, *Light intensity, Silts, Forage fish.
Identifiers: *Gizzard shad.

Turbidity is a considerable water quality problem throughout the Midwest. This project investigated the effect of high turbidity levels and the resulting low light intensities within lakes on the feeding (ecology) of two important large fish: bluegill sunfish (*Lepomis macrochirus*) and gizzard shad (*Dorosoma cepedianum*). Because the distance at which visual-feeding fish can see their prey has been shown to be important to their feeding ecology. The reactive distance of bluegill sunfish to different sizes of zooplankton prey under a variety of light intensities and turbidities was measured. The fishes' reactive distance was greatest at light intensities greater than 10 lx and at low turbidities; as the turbidity gets higher and light lower, fish have more difficulty finding their prey. Thus high turbidity has a detrimental effect on such visual feeding forage fish as the bluegill. Gizzard shad, however, do not feed visually but instead pump water through their gills as they swim and retain any particles large enough to be held by the gill rakers. Since silt is fine and passes through the gill rakers, the feeding of these fish would not be expected to be altered by turbidity. It therefore appears that turbid conditions give gizzard shad feeding fish a competitive advantage over the visual feeders.
W77-07817

INVESTIGATION OF ACID MINE DRAINAGE EFFECTS ON RESERVOIR FISHERY POPULATIONS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5C.
W77-07827

HYDROCHEMISTRY OF THE NIGULA SWAMP, (IN ESTONIAN),
Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.
U. Maegi.
Festi Nsv Tead Adak Toim Biol 25(3), p 245-248, 1976.

Descriptors: *Water chemistry, *Swamps, *Peat, Precipitation (Atmospheric), Organic matter, Infiltration, Wetlands, Water pollution.
Identifiers: *Estonian-SSR (Nigula Swamp), USSR.

Hydrochemical studies indicated that the surface swamp (Estonian SSR, USSR) was fed by atmospheric precipitation. While it flows down and infiltrates through peat layers, it is enriched by water-soluble organic substances, but it does not contact water rich in minerals.—Copyright 1977, Biological Abstracts, Inc.
W77-07859

A SECOND LOOK AT WATER REUSE,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-07908

PHYTOPLANKTON PRODUCTION IN LAKE MEMPHREMAGOG, QUEBEC (CANADA)—VERMONT (U.S.A.),
For primary bibliographic entry see Field 5C.
W77-07962

PHYSICAL, CHEMICAL, AND BIOLOGICAL FACTORS IN THE INITIATION AND DESTRUCTION OF BIOGENIC MEROMIXIS IN A SOFT-WATER LAKE,
For primary bibliographic entry see Field 5C.

W77-07963

WHOLE-LAKE EUTROPHICATION EXPERIMENTS WITH PHOSPHORUS, NITROGEN AND CARBON.
For primary bibliographic entry see Field 5C.
W77-07965

A CARBON BUDGET FOR LAKE ONTARIO,
For primary bibliographic entry see Field 5C.
W77-07967

DIEL PHOSPHATE FLUX IN LAKE WASHINGTON, U.S.A.,
For primary bibliographic entry see Field 5C.
W77-07968

HYDROPHYTE BIOMASS AND COMMUNITY STRUCTURE IN A SMALL OLIGOTROPHIC NEW HAMPSHIRE LAKE,
For primary bibliographic entry see Field 5C.
W77-07969

PHOSPHORUS REGENERATION BY NATURAL POPULATIONS OF LIMNETIC ZOOPLANKTON,
For primary bibliographic entry see Field 5C.
W77-07972

TEMPORAL AND SPATIAL PATTERNS OF DINOFLAGELLATE BLOOMS IN LAKE KINNERET, ISRAEL (1969-1974),
For primary bibliographic entry see Field 5C.
W77-07973

NUTRIENT LIMITATION IN A SMALL OLIGOTROPHIC LAKE IN NEW HAMPSHIRE,
For primary bibliographic entry see Field 5C.
W77-07974

INFLUENCE OF SUSPENDED SEDIMENT ON THE TEMPERATURES OF SURFACE WATERS OF RESERVOIRS,
For primary bibliographic entry see Field 5C.
W77-07975

OXYGEN UPTAKE OF SEDIMENTS IN CASTLE LAKE, CALIFORNIA,
For primary bibliographic entry see Field 5C.
W77-07976

PLANKTONIC PRIMARY AND BACTERIAL PRODUCTIVITY IN SHALLOW WATERS WITHIN A LARGE PHRAGMITES COMMUNITY (NEUSIEDLERSEE, AUSTRIA),
For primary bibliographic entry see Field 5C.
W77-07977

POPULATION ECOLOGY AND PRODUCTION OF BENTHIC DETRITIVORES,
For primary bibliographic entry see Field 5C.
W77-07979

SEDIMENTATION IN LOWER GREEN BAY, WISCONSIN,
For primary bibliographic entry see Field 2J.
W77-07980

THE APPLICATION OF ERTS-1 DIGITAL DATA TO WATER TRANSPORT PHENOMENA IN THE POINT PELEE-RONDEAU AREA,
For primary bibliographic entry see Field 2J.
W77-07981

VISUAL OBSERVATIONS OF PHOSPHORUS MOVEMENT BETWEEN ALGAE, BACTERIA, AND ABIOTIC PARTICLES IN LAKE WATERS, Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
For primary bibliographic entry see Field 5C.
W77-07983

LOW FREQUENCY TURBULENCE AND VERTICAL TEMPERATURE MICROSTRUCTURE IN LAKE TAHOE, CALIFORNIA-NEVADA, T. M. Dillon, T. M. Powell, and L. O. Myrup. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part 1, p. 110-115, 1975. 2 fig., 1 tab., 12 ref.

Descriptors: *Instrumentation, *Water temperature, *Bathythermographs, *Differential thermal analysis, Analytical techniques, Measurement, Depth, Diffusivity, Nevada, California, Water pollution sources.
Identifiers: *Lake Tahoe (Calif.-Nev.), *Vertical temperature gradients.

Lake depth temperature profile plots are usually presented as smooth curves, masking considerable detailing in structure of temperature, including 'stair steps' and inversions. Thus, estimates of thermal eddy diffusivities can be obtained from a careful analysis of the small-scale irregularities. A device is described which can resolve the 50 cm spectral level by modifying an expendable bathythermograph probe, which consists of a thermistor mounted on a streamlined body containing a 450 m section of fine two-conductor copper wire mounted on a spool from which it freely unwinds. A second section of the same wire is wound on a similar spool which remains on board when the probe is launched. Modification of the probe involves attaching a large funnel to slow the rate of descent and mounting four large rectangular wings on the drag funnel to provide further drag and spin the probe about its vertical axis to ensure uniform vertical descent. The descent rate is taken concurrently with a conventional thermistor. The fall rate is normally about 13 cm/sec and the time constant for XBT thermistor is 0.1 seconds, so that under ideal conditions features on the order of 3 cm might be resolved. The spectrum was uncontaminated at wavelengths greater than 25 cm during measurements taken at Lake Tahoe. (Auen-Wisconsin)
W77-07984

STABILITY IN STRUCTURE AND FUNCTION OF THE MUD-WATER INTERFACE,
For primary bibliographic entry see Field 5C.
W77-07985

THE INVERTEBRATES ON SUBMERGED MACROPHYTES IN THREE MASURIAN LAKES,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W77-07987

THE INFLUENCE OF MINERAL FERTILIZATION ON PHYTOPLANKTON PRODUCTION IN LAKES OF VARIOUS TROPHIC TYPES, Instytut Rybactwa Środladowego Olsztyn Korto (Poland). Zakład Hydrobiologii.
For primary bibliographic entry see Field 5C.
W77-07988

PHOSPHORUS: CHANGES IN ECOSYSTEM METABOLISM FROM REDUCED LOADING,
For primary bibliographic entry see Field 5C.
W77-07989

SEDIMENTATION: MEASUREMENTS IN EXPERIMENTAL ENCLOSURES,
For primary bibliographic entry see Field 5C.
W77-07990

BACTERIAL DECOMPOSITION OF DIFFERENT POLYSACCHARIDES IN A EUTROPHIC LAKE,
For primary bibliographic entry see Field 5C.
W77-07991

ELECTRON TRANSPORT ANALYSIS AS AN INDICATOR OF BIOLOGICAL OXIDATION IN FRESHWATER SEDIMENTS,
For primary bibliographic entry see Field 5C.
W77-07992

OPTIMAL GROWTH TEMPERATURES AND MEDIA PARAMETERS OF BACTERIAL COMMUNITIES FROM LAKES OF DIFFERENT TROPHIC STATES,
For primary bibliographic entry see Field 5C.
W77-07994

THE INFLUENCE OF TEMPERATURE AND BACTERIAL NUMBERS ON THE HETEROTROPHIC UPTAKE OF C14 GLUCOSE IN WEST BLUE LAKE, MANITOBA,
For primary bibliographic entry see Field 5C.
W77-07995

BIOLOGICAL LONG-TERM INVESTIGATIONS OF SWEDISH LAKES,
For primary bibliographic entry see Field 5C.
W77-07998

PHOSPHORUS RELEASE FROM A HIGHLY EUTROPHIC LAKE SEDIMENT,
For primary bibliographic entry see Field 5C.
W77-07999

THE EFFECT OF HIGHWAY DEICING SALT ON CHLORIDE BUDGETS AT LAKE GEORGE, NY,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5B.
W77-08000

STUDIES ON THE ROLE OF DETRITUS IN FRESH WATER LAKES,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5C.
W77-08001

CHEMICAL INTERACTIONS IN A EUTROPHIC LAKE,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5C.
W77-08002

THE AVAILABILITY OF CHLOROPHYLLIDE IN HYDROPHYTES AND ALGAS OF LAKE TRASIMENO AND THE VARIABILITY OF PIGMENT CONTENT IN SPIROGYRA, (IN ITALIAN),
Perugia Univ. (Italy). Istituto di Orto Obot.
For primary bibliographic entry see Field 5C.
W77-08044

MODELING MULTIPLE-USE IN NATURAL AREAS: PART II - THE SANTEE SWAMP STUDY,
Ryckman, Edgerley, Tomlinson and Associates, Inc., St. Louis, Mo.
For primary bibliographic entry see Field 6A.
W77-08050

THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE INVENTORY OF

PLAYA LAKES IN THE HIGH PLAINS OF TEXAS,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 7B.
W77-08077

2J. Erosion and Sedimentation

EVALUATION OF SEDIMENT YIELDS DUE TO URBAN DEVELOPMENT,
Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W77-07705

EFFECTS OF SAMPLE HANDLING ON THE COMPOSITION OF MARINE SEDIMENTARY PORE WATER,
Lehigh Univ., Bethlehem, Pa. Center for Marine and Environmental Studies.
For primary bibliographic entry see Field 5A.
W77-07742

SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS,
EG and G Washington Analytical Services Center, Inc., Rockville, Md.
For primary bibliographic entry see Field 2L.
W77-07748

FLOODING FREQUENCY OF HYPERSALINE COASTAL ENVIRONMENTS DETERMINED BY ORBITAL IMAGERY: GEOLOGIC IMPLICATIONS,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2L.
W77-07751

SOIL FORMATION ON LOESS IN SOUTHWESTERN INDIANA: I. LOESS STRATIGRAPHY AND SOIL MORPHOLOGY,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-07762

SOIL FORMATION ON LOESS IN SOUTHWESTERN INDIANA: II. DISTRIBUTION OF CLAY AND FREE OXIDES AND FRAGIPAN FORMATION,
Purdue Univ., Lafayette, Ind. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-07763

GULLY WALL STABILITY IN LOESS-DERIVED ALLUVIUM,
Agricultural Research Service, Columbia, Mo.
For primary bibliographic entry see Field 4D.
W77-07764

RUNOFF, EROSION, AND NUTRIENT MOVEMENT FROM INTERRILL AREAS,
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Engineering.
E. J. Monke, H. J. Marelli, L. D. Meyer, and J. F. DeJong.
Transactions of the American Society of Agricultural Engineers, Vol. 20, No. 1, p 58-61, January-February 1977. 4 fig, 6 tab, 9 ref.

Descriptors: *Runoff, *Erosion, Laboratory tests, Simulated rainfall, Precipitation (Atmospheric), Soil erosion, Suspended solids, *Nutrients, Nitrogen, Phosphorus, Inflow, *Overland flow, Soils, Loam, Silts, Sediments, Agriculture, *Rainfall.

The influence of rainfall and overland flow on interrill erosion and associated nutrient losses was

studied for flatland conditions. Interrill erosion rates were substantially large. However, amounts of eroded soil reaching actual stream systems may be greatly reduced, depending on the severity of storms. Interrill erosion rates can be decreased substantially by improved till. In soils with excellent till, the silt fraction in the eroded soil was higher than in the original soil, and the clay and sand fractions were lower. Although N and P concentrations in the soils with excellent till were quite high, losses of these nutrients in sediment runoff were low because of increased infiltration. (Sims-ISWS)
W77-07766

EVALUATION OF POTENTIAL USE OF VEGETATION FOR EROSION ABATEMENT ALONG THE GREAT LAKES SHORELINE,
Dames and Moore, Cincinnati, Ohio.
For primary bibliographic entry see Field 4D.
W77-07788

DEVELOPMENT OF THE TURBIDITY MAXIMUM IN RAPPAHANNOCK ESTUARY; SUMMARY,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 2L.
W77-07789

CLASTIC SEDIMENTATION IN A MODERN ALPINE LAKE,
Wyoming Univ., Laramie, Dept. of Geology.
D. Mankiewicz, J. R. Steidtmann, and L. E. Borgman.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A016 078, Price codes: A02 in paper copy, A01 in microfiche. Report ARO 10087.1-EN, Reprinted from Journal of Sedimentary Petrology, Vol. 45, No. 2, p 462-468, June 1975. 4 fig, 7 ref. Army DA-ARO-D-31-124-72-G76.

Descriptors: *Sedimentation, *Lakes, *Lake sediments, *Wyoming, Geology, Rocks, On-site investigations, Data collections, On-site data collections, Analytical techniques, Sediments, Sediment sorting, Mineralogy, Heavy metals, Sediment transport, Sedimentology.
Identifiers: *Sediment sources, *Green Lake (Wyo).

The redistribution of sediment by lacustrine processes operating in Green Lake, Teton County, Wyoming, was in order to determine the factors which control sediment entrapment and to evaluate the effectiveness of entrapment as a control on downstream sediment mineralogy. Sediment patterns in the lake were identified by means of factor analysis of heavy minerals data. The results of these analyses showed that detritus from sedimentary sources to the west is trapped in the lake, whereas sediment derived from Precambrian crystalline rocks to the east is carried through the lake and out the outlet. These relations are controlled by drainage slope and pattern, lake geometry and bathymetry, and source lithology. Because of the selective sediment entrapment, it would not be possible to predict the source rock compositions in Green Lake Basin by examining the mineralogy of downstream sediments. (Sims-ISWS)
W77-07791

OXYGEN UPTAKE OF SEDIMENTS IN CASTLE LAKE, CALIFORNIA,
For primary bibliographic entry see Field 5C.
W77-07976

SEDIMENTATION IN LOWER GREEN BAY, WISCONSIN,
J. M. Pezzetta.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part 1, p. 123-132, 1975. 3 fig., 28 ref.

Field 2—WATER CYCLE

Group 2J—Erosion and Sedimentation

Descriptors: *Sedimentation rates, *Deposition(Sediments), *Sediment transport, *Shallow water, Particle shape, Particle size, Powerplants, Estuaries, Obstruction to flow, *Wisconsin, *Lake Michigan, Bays.
Identifiers: *Lower Green Bay(Lake Michigan), *Fox River(Wis).

As part of a research program to determine effects of a coal-fired power plant on the waters of the partially-restricted southern extreme end of Green Bay, Lake Michigan, an evaluation was made of textural characteristics and dispersal patterns of the sediments in this semi-enclosed portion of the bay. Of 27 pre-determined sampling sites, 13 were sampled in January, 11 in February and the full complement in March, 1973. Trends of three primary textural parameters (mean grain size, standard deviation or sorting, and skewness) indicate that a complex interaction occurs between two processes: (1) the fluvial system, mainly the discharge of the Fox River as the main mechanism to deposit coarse silt; and (2) the lacustrine environment of the shallow lower bay receiving basin, in which the sediment distribution patterns are controlled largely by wind-induced turbulence and a general counterclockwise current system. Texture is generally uniform, although seasonal fluctuations in the Fox River discharge affect the quantity of transported sediment. The mean gradient of the river is sufficient to produce at the river mouth a flow velocity of 9.0 cm/sec, more than adequate to transport coarse silt-sized sediments. Even if the velocity were reduced by a factor of two during the winter, such a flow rate would still be enough to carry the sediments and to transport them into the lower bay. (Harris-Wisconsin)

W77-07980

THE APPLICATION OF ERTS-1 DIGITAL DATA TO WATER TRANSPORT PHENOMENA IN THE POINT PELEE-RONDEAU AREA,
R. P. Bukata, W. S. Haras, and J. E. Bruton. *Verhandlungen Internationale Vereinigung Limnologie*, Vol. 19, Part I, p. 168-178, 1975. 8 fig., 14 ref.

Descriptors: *Telemetry, *Remote sensing, *Satellites(Artificial), *Land forming, *Sediment transport, *Currents(Water), *Sedimentology, *Fluid mechanics, *Canada, Digital computers, *Lake Erie, Lakes.

Identifiers: ERTS-1, Point Pelee-Rondeau area(Canada).

Digital data was telemetered from ERTS-1 satellite to develop a conceptual 'mirror-image' model defining the temporal evolution of the Point Pelee-Rondeau landforms on the Canadian shoreline of Lake Erie. Data are given in a 4-band energy response covering the visible and reflected infrared portions of the electromagnetic spectrum from 0.50 micron to 1.1 microns. The Band 5 Multispectral Scanner Subsystem data is directly correlated to surface turbidity and the Band 6 MSS data represent surface biomass concentration. Band 5 digital computer printout data illustrate bifurcating sediment transport, the fluid mechanics flow around Point Pelee and the delineation of the Archimedes spiral/vortex flow pattern. Representations of color-infrared vertical aerial photographs illustrate convergence of relict beach ridges. An illustration of the model shows a 'Quick-Look' ERTS-1 image, which depicts the appearance of geophysical formations east of Point Pelee and West of Rondeau, and the high degree of spring runoff from the Lake Huron-Lake St. Clair-Lake Erie sediment transport system with the northern half of Lake St. Clair being relatively sediment-free, and the sediment deposition extending considerably further into Lake Erie. (Auen-Wisconsin)

W77-07981

STABILITY IN STRUCTURE AND FUNCTION OF THE MUD-WATER INTERFACE.
For primary bibliographic entry see Field 5C.
W77-07985

SEDIMENTATION: MEASUREMENTS IN EXPERIMENTAL ENCLOSURES,
For primary bibliographic entry see Field 5C.
W77-07990

REMOTE SENSING OF MISSISSIPPI RIVER CHARACTERISTICS,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 7B.
W77-08070

2K. Chemical Processes

MERCURY IN WATER, A BIBLIOGRAPHY, VOLUME 3,
Office of Water Research and Technology. Washington, D. C.
For primary bibliographic entry see Field 5A.
W77-07605

METAMORPHIC REACTIONS IN FLYSCH ROCKS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
I. Barnes, and J. R. O'Neill.
In: *Proceedings of the International Symposium on Water-Rock Interaction*, Prague, Czechoslovakia, September 1974; Published by the Geological Survey, Prague, Czechoslovakia, p. 309-315, 1976. 3 tab, 19 ref.

Descriptors: *Geochemistry, *Water chemistry, *Metamorphic rocks, *Carbon dioxide, *Chemical reactions, Chemical analysis, Inorganic compounds, Chemical properties, Groundwater, Springs, Isotope studies, Meteoric water.
Identifiers: *Flysch rocks.

CO₂-rich fluids are found to issue from eugeosynclinal (flysch) rocks. The fluids are characteristically Na-HCO₃ solutions and free CO₂. The mineral assemblages in the flysch rocks are quartz, chlorite, white mica, albite, and calcite. Alteration products (metamorphic minerals) include laumontite, pumpellyite prehnite, and epidote, singly or in various combinations. The only source in the rocks of free CO₂ is calcite of marine origin from isotopic evidence. The only source in the rocks of Na is albite. The flux of CO₂ is far greater than that of Ca. The flux of Na is much greater than that of Al or Si. Therefore, Ca, Al, and Si are conserved by whatever processes occur but Na and CO₂ are fugitive. The Ca, Al, and Si remaining from the solution of albite and calcite probably form laumontite, pumpellyite, prehnite, and epidote. The free CO₂ may move independently of water involved in the reactions. No other likely mechanism will explain the high CO₂ pressure in the shallow meteoric water, identified by isotopic data, issuing from flysch sediments. (Woodard-USGS)

W77-07609

WATER SAMPLING FROM UNPUMPED WELLS WITH STATIC WATER LEVELS DEEPER THAN 10 METRES,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 5A.
W77-07787

WATER QUALITY STATUS AND TRENDS IN MINNESOTA—INDICES FOR WATER SUPPLY AND GROUND WATER POLLUTION,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 5A.

W77-07794

EFFECT OF MAJOR ION VARIATIONS IN THE MARINE ENVIRONMENT ON THE SPECIFIC GRAVITY—CONDUCTIVITY—CHLORINITY—SALINITY RELATIONSHIP,
Naval Underwater Systems Center, Newport, R.I. D. N. Connors, and D. R. Kester.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A006 724. Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: *Marine Chemistry*, Vol. 2, p. 301-304, 1974. 7 tab, 33 ref. ONR-N00014-68-A-0215-0003.

Descriptors: Water properties, *Specific gravity, *Conductivity, *Salinity, *Ions, Water resources, *Chlorine, *Sea water.
Identifiers: Marine environment, *Clorinity.

Partial equivalent conductances and partial equivalent volumes of the major constituents in seawater were used to evaluate the specific gravity—conductivity—chlorinity—salinity relationships in the marine environment. For example, in the open ocean, the relationships between Cl o/oo and both S o/oo and specific gravity are valid to within 0.014 o/oo and 0.014 sigma t, respectively. The relationships between conductivity and S o/oo and specific gravity are valid to within 0.006 o/oo and 0.007 sigma t. In river diluted nearshore areas specific gravity anomalies inferred from Cl o/oo, can be as great as 0.06 sigma t and 0.04 sigma t when inferred from a conductivity ratio measurement. (Sinha-OEIS)

W77-07802

A RAPID VOLUMETRIC METHOD OF DETERMINING FLUORINE IN WATER, (IN RUSSIAN),
Kiev Sanitary-Epidemiology Station (USSR).
For primary bibliographic entry see Field 5A.
W77-07950

HYDROLOGIC OPTICS. VOLUME I. INTRODUCTION,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07956

THE DETERMINATION OF NITRATES IN WATER, (IN RUSSIAN),
For primary bibliographic entry see Field 5A.
W77-07966

2L. Estuaries

MUTAGENIC POTENTIAL OF PETROLEUM BYPRODUCTS IN CHESAPEAKE BAY WATERS,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W77-07606

PRELIMINARY STUDIES OF MENHADEN AND THEIR MASS MORTALITIES IN LONG ISLAND AND NEW JERSEY WATERS,
New Jersey Agricultural Experiment Station, New Brunswick.
For primary bibliographic entry see Field 5C.
W77-07724

COMPARATIVE STUDY OF CLADOCERA FROM THE 1ST METER OF SEA WATER, COLLECTED IN A POLLUTED ZONE AND IN

ANOTHER RELATIVELY CLEAN ZONE, (IN FRENCH), Athens Univ. (Greece). Zoological Lab. and Museum.
For primary bibliographic entry see Field 5C.
W77-07730

THE STUDY OF THE BENTHOS COMMUNITY AROUND THE MOUTH OF THE PORT OF TAGONOURA IN SURUGA BAY, (IN JAPANESE),
For primary bibliographic entry see Field 5C.
W77-07735

EFFECT OF SOUTH LOUISIANA CRUDE OIL AND NO. 2 FUEL OIL ON GROWTH OF HETEROTROPHIC MICROORGANISMS, INCLUDING PROTEOLYTIC, LIPOLYTIC, CHITINOLYTIC AND CELLULOYTIC BACTERIA, Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-07736

MANGROVE ECOLOGY AND DELTAIC-ESTUARINE GEOMORPHOLOGY: CAMBRIDGE GULF-ORD RIVER, WESTERN AUSTRALIA, Louisiana State Univ., Baton Rouge. Center for Wetlands Resources.
B. G. Thom, L. D. Wright, and J. M. Coleman.
Available from the National Technical Information Service, Springfield VA 22161 as AD A015 161, Price 03 in paper copy, A01 in microfiche. Technical Report No. 198, December 1975. Reprinted from: *Journal of Ecology*, Vol 63, p 203-232, March 1975. 13 fig, 4 tab, 20 ref.

Descriptors: *Mangrove swamps, *Estuaries, *Deltas, *Geomorphology, Aquatic plants, *Australia, *Ecology, *Estuarine environment.
Identifiers: *Cambridge Gulf-Ord River(WA).

Mangrove distributions and growth forms in tropical deltaic-estuarine environments in may ways reflect the control of plant habitat by landform change. In the Cambridge Gulf-Ord River region of Western Australia, and area which experiences a dry monsoonal climate and a high tidal range, a variety of mangrove habitats were recognized. Those habitats are sediment complexes which have evolved over the last several thousand years as a result of certain combinations of geomorphic processes operating at a sea level very close to its present position. In that part of the Cambridge Gulf exposed to wave action, tidal and wave processes combine to produce prograding shorelines upon which grow bands of mangrove in a successional sequence. However, where the direct influence of river discharge and waves is negligible, or considerably reduced, tidal sedimentation has given rise to extensive flats bare of vegetation at approximately the high spring tide level. These flats are fringed by mangroves and associated halophytes growing along the margins of tidal creeks and channels. Stratigraphic evidence suggests more extensive halophytic plant coverage of the flats 6000-7000 years ago during the waning phase of the Holocene transgression. Since that time 3-4 m of sediment has accumulated by vertical accretion, and mangroves have become progressively restricted to sites near channels which are frequently inundated by tides. Self-maintaining mangrove communities are characteristic of these sites. (Sinha-OEIS)
W77-07738

RESULTS OF R/V YAQUINA CRUISE YALOC-74, LEG 3: SEABED DISPOSAL PROGRAM, NORTH PACIFIC STUDY AREA MPG-2, 33 DEGREES 20'N, 151 DEGREES 00'W, NOV. 30-DEC. 21, 1974, Rhode Island Univ., Kingston. Graduate School of Oceanography.

For primary bibliographic entry see Field 5E.
W77-07739

MONITORING DISSOLVED HYDROCARBONS AS A FUNCTION OF THE TIDAL CYCLE (NEW YORK HARBOR), Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B.
W77-07740

EFFECTS OF SAMPLE HANDLING ON THE COMPOSITION OF MARINE SEDIMENTARY PORE WATER, Lehigh Univ., Bethlehem, Pa. Center for Marine and Environmental Studies.
For primary bibliographic entry see Field 5A.
W77-07742

TIDAL AND CURRENT PREDICTION FOR THE AMAZON'S NORTH CHANNEL USING A HYDRODYNAMICAL-NUMERICAL MODEL, Naval Postgraduate School, Monterey, Calif. L. A. Ferraz.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A017 572. Master's Thesis, September 1975. 82 p, 22 fig, 3 tab, 21 ref, append.

Descriptors: *Tides, *Currents(Water), *Estuaries, Water resources development, Model studies, Hydrodynamics, Mathematical models, Model studies.
Identifiers: *Amazon River, Prediction models.

The hydrodynamical-numerical prediction model developed by W. Hansen is applied to the North Channel of the Amazon River for computation of tides and currents; the results are compared with tidal prediction obtained by the harmonic method and to actual current measurements. A medium size grid of square mesh cells, 1800 m in length, represents the North Channel. The driving forces are the tides at the northern opening of the channel near the river's mouth and the river discharge into the channel at the southern end. The numerical results for tides were verified at three tidal stations, and it was observed that the tides predicted at the northern part of the channel agreed, in the worse case, within 12% of the tidal range, but those predicted at the southern end were unsatisfactorily reproduced. This fact is attributed to the size of the grid which is too coarse to describe adequately the variable and irregular cross-sections and bottom topography at the southern part of the channel. The predicted currents were in acceptable agreement with a few available measurements. (Sinha-OEIS)
W77-07743

AN ANALYTICAL SEA CURRENT MODEL FOR COASTAL REGIONS WITH APPLICATION TO THE NEW YORK BIGHT, Coast Guard, Washington, D.C. Oceanographic Unit.
J. M. Bishop.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A015 372. Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 75-2, September 1975. 33 p, 7 fig, 6 ref, 3 append.

Descriptors: *Continental shelf, *Currents(Water), *Oceanography, Model studies, Seasonal, Coasts, Estuaries, New York.
Identifiers: *Outer Continental Shelf, *New York Bight.

Seasonal coastal currents on a continental shelf are modeled for use in Search and Rescue planning. The model considers a balance of Coriolis, pressure gradient, and frictional forces. Input parameters are the climatological wind and density fields. Comparison of results to currents

depicted on climatological atlases for the New York Bight indicates the validity of the approach. In this light, oceanographic conditions prevail. (Sinha-OEIS)
W77-07744

VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL, Delaware Univ., Lewes. Marine Studies Complex.
For primary bibliographic entry see Field 5B.
W77-07745

WASTE MANAGEMENT FOR THE COASTAL ZONE: CONCEPTS FOR THE ASSESSMENT OF OCEAN OUTFALLS, Assembly of Engineering Marine Board, Washington, D.C.
For primary bibliographic entry see Field 5E.
W77-07747

SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS, EG and G Washington Analytical Services Center, Inc., Rockville, Md. P. E. Shelley.
Available from the National Technical Information Service, Springfield, VA 22161 as NASA CR-2769. Price codes: A06 in paper copy, A01 in microfiche. National Aeronautics and Space Administration, Wallops Flight Ctr., Wallops Island, Va., Contractor Report No. NASA CR-2769, December 1976. 102 p, 17 fig, 6 tab, 60 ref. NASA-NAS6-2325.

Descriptors: *Estuaries, *Coasts, *Sediment transport, *Sediments, *Measurement, Management, *Remote sensing.

A survey of uses of estuarine and coastal areas is given. Problems associated with these uses are discussed, and data needs for intelligent management of these valuable areas are outlined. Suspended sediment measurements are seen to be one of the greatest needs. To help understand the complexity of the problem, a brief discussion of sediment mechanics is given, including sediment sources, characteristics, and transport. The impact of sediment mechanics on its direct measurement (sampling and analysis) is indicated, along with recommendations for directly obtaining representative data. Indirect measurement of suspended sediment by remote sensors is discussed both theoretically and in the light of some recent experiences. The need for an integrated, multidisciplinary program to solve the problem of quantitatively measuring suspended sediment with remote sensors is stressed, and several important considerations of such a program and benefits to be derived therefrom are briefly addressed. It is recommended that the present, very preliminary look be expanded into a full-blown program plan for developing a timely and affordable solution to the problem. (Sinha-OEIS)
W77-07748

UTILIZATION OF MIXED HYDROCARBON SUBSTRATE BY PETROLEUM-DEGRADING MICROORGANISMS, Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.
W77-07749

FLOODING FREQUENCY OF HYPERSALINE COASTAL ENVIRONMENTS DETERMINED BY ORBITAL IMAGERY: GEOLOGIC IMPLICATIONS, University of Southern California, Los Angeles. Dept. of Geological Sciences. S. P. Vonder Haar, and D. S. Gorsline.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024

Field 2—WATER CYCLE

Group 2L—Estuaries

588, Price codes: A02 in paper copy, A01 in microfiche. Southern California University Report USC-GEOL 76-04, April 1976. Reprinted from: Science, Vol 190, p 147-149, 10 October 1975. 5 p, 2 fig, 12 ref. ONR-N00014-76-C-0061.

Descriptors: Flooding, *Sedimentation, *Coasts, Geology, Geography, Frequency, *Mexico, *Monitoring, *Remote sensing.
Identifiers: *Coastal environments, Orbital imagery, *Baja California.

Available satellite imagery in the infrared and near-infrared wavelengths provides a simple, rapid, and low-cost method for monitoring the extent and duration of the flooding of coastal ecosystems. Hypersaline environments in Baja California, Mexico are flooded as a result of complex interactions between the higher of the two spring tides each month and local winds. Such flooding necessitates a reappraisal of ideas on rhythmic lamination in algal mats, stromatolites, and evaporite sediments preserved in the geologic record. (Sinha-OEIS)
W77-07751

IMPACTS OF OFFSHORE OIL ON NORTH EAST SCOTLAND,
Massachusetts Inst. of Tech. Cambridge.
For primary bibliographic entry see Field 5C.
W77-07752

PRELIMINARY PROJECTIONS OF OIL SPILL MOVEMENT FOR THREE POTENTIAL DEEP-WATER PORT SITES IN THE GULF OF MEXICO,
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B.
W77-07753

TAR BALL DISTRIBUTION IN THE WESTERN NORTH ATLANTIC,
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B.
W77-07757

THE SCALING OF VELOCITY FLUCTUATIONS IN THE SURFACE MIXED LAYER,
Woods Hole Oceanographic Institution, Mass.
I. S. F. Jones, and B. C. Kenney.
Journal of Geophysical Research, Vol. 82, No. 9, p 1392-1396, March 20, 1977. 3 fig, 1 tab, 12 ref. BNL 325373-S.

Descriptors: *Velocity, *Fluctuations, *Waves(Water), *Winds, Oceans, Lakes, Turbulence, Shear stress, Mixing, On-site investigations, Measurement, Data processing, Ocean waves, Limnology, Oceanography.
Identifiers: *Velocity spectra, Mixed layer.

Turbulent velocity fluctuations in the upper portions of the wind-driven mixed layer of oceans or lakes appear to have a velocity scale proportional to the friction velocity and a length scale proportional to the distance below the free surface, as is usual in shear flows near a boundary. A number of one-dimensional velocity spectra were measured in aquatic mixed layers, and these spectra, when they are scaled with the surface stress and the distance from the free surface, were compared with turbulent boundary layer measurements. The good agreement suggests that the surface wave orbital velocities act merely as 'inactive' motions and do not interfere with the lower-frequency stress-carrying eddies. (Sims-ISWS)
W77-07768

OBSERVATIONS OF WAVE HEIGHT AND WAVE CELERITY IN THE SURF ZONE,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.

J. N. Suhayda, and N. R. Pettigrew.
Journal of Geophysical Research, Vol. 82, No. 9, p 1419-1424, March 20, 1977. 11 fig, 18 ref.

Descriptors: *Waves(Water), *Beaches, *Surf, Height, Celerity, Ocean waves, Coasts, On-site investigations, On-site data collections, Measurement, Data processing, Oceanography.
Identifiers: *Surf zone waves, *Barbados(West Indies).

Observations of wave crest elevation, wave trough elevation, and wave celerity were made in the surf zone on a natural beach. A series of 22 wave poles having vertical gradations of 7 cm (near shore) and 11 cm (off shore) was placed across the surf zone from outside the break point to the swash zone. Movements of 10 individual waves, all having a break point within one wave pole spacing of each other, were photographed, and the data on wave height changes and wave speed changes were analyzed. Wave celerity within the surf zone, given as a ratio M to solitary wave celerity, shows a systematic increase of wave speeds near the break point to a peak of M approximately equal to 1.2, thence a decrease farther shoreward to M approximately equal to 0.8, and finally, a second increase where M is greater than 1. Wave height decay after breaking follows the theory of turbulent dissipation recently presented by Sawaragi and Iwata. The wave height to water depth and ratio within the surf zone is a function of distance from the break point and ranges from 2.0 to 0.6. The results indicated that the use of linear and nonlinear nonviscous wave theories to quantify surf zone wave characteristics is misleading insofar as quantitative prediction is concerned. (Sims-ISWS)
W77-07770

OBSERVATIONAL AND NUMERICAL EVIDENCE FOR WIND-FORCED COASTAL TRAPPED LONG WAVES,
Massachusetts Inst. of Tech. Cambridge. Dept. of Earth and Planetary Sciences.
A. J. Clarke.
Journal of Physical Oceanography, Vol. 7, No. 2, p 231-247, March 1977. 5 fig, 6 tab, 47 ref, append. NSF ID07503998

Descriptors: *Waves(Water), *Winds, *Coasts, *Lake Ontario, *Oregon, Oceans, Ocean waves, Lakes, Model studies, Mathematical models, On-site investigations, Topography, Shores, Stress, Mixing, Limnology, Oceanography.
Identifiers: *Coastal trapped waves.

Recent work has shown that the linear, wind-forced quasi-geostrophic motion of stratified water over shelf topography can be described by a sum of modes, the amplitude of each of these modes satisfying a forced, first-order wave equation. The analysis presented suggests that this forced wave equation can qualitatively explain a wide range of observational and numerical results. (Sims-ISWS)
W77-07771

AN EXPERIMENTAL AND THEORETICAL STUDY OF THE TURBULENT AND LAMINAR CONVECTION GENERATED UNDER A HORIZONTAL ICE SHEET FLOATING ON WARM SALTY WATER,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 2C.
W77-07773

THE ERRORS INVOLVED IN INFERRING SALINITY FROM SOUND VELOCITY,
Texas A and M Univ., College Station. Dept. of Oceanography.
W. J. Emery.
Journal of Physical Oceanography, Vol. 7, No. 2, p 293-297, March 1977. 2 fig, 5 tab, 8 ref.

Descriptors: *Salinity, *Oceans, *Measurement, *Equations, Conductivity, Pressure, Temperature, Water temperature, Sound waves, Density, Sea water, *Instrumentation, Oceanography.
Identifiers: *Error analysis.

Four empirical equations relating sound velocity, salinity, temperature, and pressure were examined to determine the errors in computing salinity from measurements of temperature, pressure, and sound velocity. The measurement errors in these variables lead to rms salinity errors of 0.2 parts per thousand for an expendable device and 0.04 parts per thousand for a moored instrument. The magnitude of the salinity error appears independent of the equation used. Salinities computed using Lovett's and Del Grosso's equations agreed well, but differed from salinities computed using either of Wilson's equations. (Sims-ISWS)
W77-07774

THE GENERATION OF SALINITY FINESTRUCTURE BY VERTICAL DIFFUSION,
City Univ. of New York. Inst. of Marine and Atmospheric Sciences.
E. S. Posmentier.
Journal of Physical Oceanography, Vol. 7, No. 2, p 298-300, March 1977. 3 fig, 5 ref.

Descriptors: *Diffusion, *Salinity, *Equations, Mathematical models, Oceans, Model studies, Estuaries, Stability, Numerical analysis, Oceanography.
Identifiers: *Salinity finestructure, Diffusion equations, Vertical diffusion, Equation solutions.

The nonlinear differential equation for the vertical diffusion of salt (or heat) has initially unstable solutions under conditions of high gravitational stability. The solutions stabilize as they approach alternating layers of high and low salinity gradient. A numerically computed example of this phenomenon resembles salinity finestructure observed in the Hudson Estuary. However, similar computations may result in the generation of mathematically artificial finestructure if the diffusion coefficient is not adequately smoothed or if unrealistic initial conditions are used. (Sims-ISWS)
W77-07775

DETERMINATION OF SALT-WATER INTERFACE BY ELECTRIC RESISTIVITY DEPTH SOUNDINGS,
Tel Aviv Univ. (Israel). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2F.
W77-07783

HEAT AND SALT TRANSFER ASSOCIATED WITH FORMATION OF SEA-ICE,
Cambridge Univ., (England). Dept. of Applied Mathematics and Theoretical Physics.
For primary bibliographic entry see Field 2C.
W77-07786

DEVELOPMENT OF THE TURBIDITY MAXIMUM IN RAPPAHANNOCK ESTUARY; SUMMARY,
Virginia Inst. of Marine Science, Gloucester Point. M. M. Nichols.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A015 786, Price codes: A02 in paper copy, A01 in microfiche. Report ARO 8524. I-EN Reprinted from Memoires de l'Institut de Geologie du Bassin d'Aquitaine, No 7, p 19-25, 1974. 7 p, 6 fig, 1 tab, 4 ref. Army DA-ARO-D-31-124-70-G47.

Descriptors: *Estuaries, *Turbidity, *Suspended solids, Tides, Tidal waters, Coasts, Rivers, Continental shelf, Sedimentation, Currents(Water), Circulation, Water circulation, Salinity, Saline water-freshwater interfaces, On-site investiga-

tions, On-site data collections, Sedimentology, *Virginia, Pollutant identification.
Identifiers: *Turbidity maximums, *Rappahannock Estuary(Va).

The dynamic behavior of the turbidity maximum in the Rappahannock Estuary of the Chesapeake region has been traced through a full life cycle with changes in river inflow and haline mixing. At all levels of inflow, the maximum resides within the estuary. Its locus lies just upstream of the 1 part per thousand isohaline, and its position shifts upstream with penetration of the salt intrusion. Development follows a sequence beginning with high inflow or a major seaward surge of turbulent flood water: (1) formation of an enriched turbid aureole with near-surface and near-bottom maxima and a lean core at mid-depth, (2) progressive upstream migration and vertical (i.e. turbid) homogeneity in a narrow zone, (3) local intensification near the bottom with a partly layered structure, and (4) slow decay and dispersion over a broad zone. The maximum reappears with each seasonal (spring) inflow, and it subsists for a life span of 4-16 weeks as estuarine mixing increases. Time-series observations of velocity over 16 to 26 tidal cycles through the maximum define a near-bottom convergence or node where river and estuarine flow meet. Measurements of residual sediment transport show that a significant amount of suspended sediment accumulates in the maximum, approximately four times the river load, despite losses by downstream advection in near-surface water, diffusion and settling-out on the bottom or in bordering marshes. The observations point to river inflow as the chief factor controlling position of the maximum. (Sims-ISWS)
W77-07789

CITIZEN ATTITUDES TOWARD MANAGEMENT OF THE CHESAPEAKE BAY,
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W77-07796

INVENTORY OF BENTHIC ORGANISMS AND PLANKTON AT MOKAPU, OAHU,
Hawaii Univ., Honolulu. Water Resources Research Center.
A. R. Russo, Steven J. Dollar, and E. A. Kay.
Technical Report No. 101, January 1977. 30 p, 16 fig, 7 tab, 9 ref, append.

Descriptors: *Biological communities, *Coral, Benthic fauna, *Hawaii, Marine animals, *Outfall sewers, Sewage effluents, Benthos, Marine fish, Standing crops, Water pollution, Waste disposal, Mollusks, Data collections, Plankton.
Identifiers: *Oahu(Hawaii).

An inventory of benthic and planktonic marine communities at Mokapu Point, Oahu, compiled in July to August 1975, prior to the completion of an outfall and discharge of secondary sewage effluent, has been prepared for the City and County of Honolulu. Data were obtained from five transects between Mokapu Point on the northeastern tip of Oahu to Alala Point, approximately 6 km (4 miles) south, at depths of from 6 to 30 m (20 to 100 ft). The area is exposed to predominant northeast tradewinds. Coral cover ranges from 20% at the 6 m depth stations to 85% at greater depths, with the most abundant corals at depths of from 12 to 18 m (40 to 60 ft). Four species of corals dominate the survey area, Pocillopora meandrina, Porites lobata, P. compressa, and Montipora sp. Most of the stations surveyed had little or no algal cover. Standing crop of fishes and mollusks decreases from stations A through C (north to south) and increases at stations D and E (the southernmost of the transects). The dominant fish are acanthurids and chaetodontids. The dominant mollusks are gastropods, primarily the caudofoveate Tricolia variabilis and Lepothyra rubricincta, rissoids, cerithiids, and dialids.

Total numbers of fish are not dependent on coral cover, but standing crop of micromollusks decreases with increasing coral cover and depth. Standing crop of net phytoplankton cells (<100 micro) Measure 3 2000 to 3000 cells per cm³ but does not vary significantly with area. Macrozooplankton abundance decreases from north to south. Transect A is distinguished by an especially high energy environment, reflected by the low standing crop and mixed species composition of micromollusks. Transect B, the proposed outfall site, is hard and flat, and mostly devoid of coral cover; very few fish were seen at this station.
W77-07798

DETERMINATION OF THE LEEWAY OF OIL SLICKS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 5B.
W77-07800

EFFECT OF MAJOR ION VARIATIONS IN THE MARINE ENVIRONMENT ON THE SPECIFIC GRAVITY-CONDUCTIVITY-CHLORINITY-SALINITY RELATIONSHIP,
Naval Underwater Systems Center, Newport, R.I.
For primary bibliographic entry see Field 2K.
W77-07802

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM.
National Marine Fisheries Service, Seattle, Wash.
For primary bibliographic entry see Field 5C.
W77-07830

EFFECT OF SALINITY ON THE FRESH-WATER SHRIMP DIKEROGAMMARUS HAEMOBAPHES (EICHWALD) FROM THE MOUTH OF THE DNEPR,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
For primary bibliographic entry see Field 5C.
W77-07848

HYDROLOGIC OPTICS. VOLUME V. PROPERTIES,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07960

A GOAL INTERVAL PROGRAMMING MODEL FOR RESOURCE ALLOCATION IN A MARINE ENVIRONMENTAL PROTECTION PROGRAM,
Texas Univ. at Austin. Center for Cybernetic Studies.
For primary bibliographic entry see Field 6G.
W77-08042

INFLUENCE OF MUSSEL METABOLITES ON THE DYNAMICS OF NUTRIENTS IN THE COASTAL WATERS OF THE EASTERN MURMAN COAST, (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Institut (USSR).
For primary bibliographic entry see Field 5C.
W77-08043

A THEORETICAL FRAMEWORK FOR THE DESCRIPTION OF ESTUARIES,
Goteborg Univ. (Sweden). Dept. of Oceanography.
G. Walin.
Tellus, Vol. 29, No. 2, p 128-136, 1977. 2 fig, 2 ref.

Descriptors: *Estuaries, *Basins, *Model studies, Mathematical models, Salinity, Salts, Flow, Mass transfer, Heat transfer, Radiation, Tracers, Mixing, Inflow, Oceanography, Foreign research.

Identifiers: *Baltic Sea.

A theoretical framework for the description of an estuarine system was outlined, with particular reference to the Baltic. The description, in terms of continuous functions of salinity and time, may be considered as an improvement of existing 'box models', which are inherently incapable of making efficient use of hydrographic data. Relations between deep water supply and internal mixing properties, as well as the equations controlling diffusion of substances in general, were derived, and their applicability was discussed. (Sims-ISWS)
W77-08057

THE LATERAL MOVEMENT OF THE COASTAL WATER AND ITS RELATION TO VERTICAL DIFFUSION,
Nordland Regional Coll., Bodo (Norway). Fishery Div.
M. Haakstad.
Tellus, Vol. 29, No. 2, p 144-150, 1977. 5 fig, 1 tab, 22 ref.

Descriptors: *Coasts, *Estuaries, *Fjords, Circulation, Water circulation, Ocean circulation, Model studies, Mathematical models, Diffusion, Flow, Movement, Salinity, Saline water-fresh-water interfaces, Oceans, Foreign countries, Foreign research, Oceanography.
Identifiers: *Norway.

Lateral oscillations in the transition between coastal and oceanic waters are likely to be a general phenomenon. Along the Norwegian coast this phenomenon has been observed and discussed since the time of Fridtjof Nansen and other early Norwegian pioneers, but so far no satisfactory explanation has been given. This article showed that a seasonal variation in the vertical diffusion may cause a corresponding oscillation in the lateral extent of the coastal water. (Sims-ISWS)
W77-08058

HYDROCARBONS IN EASTERN CANADIAN MARINE WATERS DETERMINED BY FLUORESCENCE SPECTROSCOPY AND GAS-LIQUID CHROMATOGRAPHY,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5A.
W77-08060

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PREPARATION OF COMPOSITE REVERSE OSMOSIS MEMBRANES BY PLASMA POLYMERIZATION,
Research Triangle Inst., Research Triangle Park, N.C.
H. Yasuda, and N. Morosoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 359. Price codes: A14 in paper copy, A01 in microfiche. Final Report No. OWRT/S-77/3, April 27, 1977. 314 p. OWRT 14-30-3157 and 14-30-3301.

Descriptors: *Reverse osmosis, *Membranes, *Membrane processes, *Desalination processes, Plastic polymers, Desalination apparatus, Porous media.
Identifiers: *Plasma polymerization, *Composite RO membranes, Porous substrates.

Composite reverse osmosis membranes are formed by plasma polymerization onto a porous substrate. An inductively coupled system is used with the substrate in a fixed position relative to the monomer inlet and to the coil supplying power to

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3A—Saline Water Conversion

the system. Deposition rate is independent of power if one works with the 'full glow' regime. The chemical nature of the polymer is also independent of power over a wide range. A system is described for a study of the effect of the chemical nature of the monomer(s) on the physical and chemical properties of the plasma polymer formed. The chemical nature of the polymer, the concentration of trapped free radicals, its stability, permeability, surface energy and internal stress can be controlled by choice of monomer(s). Composite reverse osmosis membranes are formed using a porous polymeric film substrate in the inductively coupled system using nitrogen containing monomers or a combination of a hydrocarbon plus nitrogen or carbon monoxide. Up to 99.5% salt rejections from 3.5% NaCl at 1500 psi have been achieved together with high water fluxes. Good salt rejection accompanied by resistance to chlorine has been found using CO as a comonomer. The effects of pretreatment of the substrate with nonpolymerizing nitrogen followed by coating using nitrogen as a comonomer is to increase salt rejection at the expense of chlorine resistance. A method of measuring porosity in dry membranes was developed and the porosity of composite membranes was measured and related to their salt rejection. The shift from hydraulic to diffusive water permeability with increasing salt rejection has also been demonstrated. Preliminary studies have been carried out using hollow fibers which move through the plasma using both an inductively coupled system and a capacitively coupled system with internal electrodes.

W77-07792

3B. Water Yield Improvement

MANUEL TECHNIQUE DU VILLAGE, (VILLAGE TECHNOLOGY HANDBOOK), (VOLS. 1 AND 2).
Volunteers in Technical Assistance, Mt. Rainier, Md.
For primary bibliographic entry see Field 3F.
W77-07628

MAKING AQUATIC WEEDS USEFUL: SOME PERSPECTIVES FOR DEVELOPING COUNTRIES.
National Academy of Sciences, Washington, D.C. Commission on International Relations.
For primary bibliographic entry see Field 4A.
W77-07964

STATISTICAL FORECASTING OF SNOW AVALANCHES, SAN JUAN MOUNTAINS, SOUTHERN COLORADO, U.S.A.,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W77-08055

3C. Use Of Water Of Impaired Quality

MODEL OF SALT FLOW IN SOIL WITH A SOURCE-SINK TERM,
Utah State Univ., Logan. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-07761

ESTABLISHING SOIL ELECTRICAL CONDUCTIVITY-SALINITY CALIBRATIONS USING FOUR-ELECTRODE CELLS CONTAINING UNDISTURBED SOIL CORES,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 2G.
W77-07776

COMPARISONS OF TWO MODELS FOR PREDICTING THE RELATIVE HYDRAULIC CONDUCTIVITY OF SALT-AFFECTED SWELLING SOILS,
Khartoum Univ. (Sudan). Dept. of Biochemistry and Soil Science.
For primary bibliographic entry see Field 2G.
W77-07777

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
For primary bibliographic entry see Field 7B.
W77-08064

3D. Conservation In Domestic and Municipal Use

WORKSHOP PROCEEDINGS -- RESEARCH NEEDS RELATED TO RECYCLING URBAN WASTEWATER ON LAND,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 5D.
W77-07607

MUNICIPAL INFORMATION SYSTEMS: EVALUATION OF POLICY RELATED RESEARCH. VOLUME 2. COMPUTER UTILIZATION IN LOCAL GOVERNMENT,
California Univ., Irvine. Urban Information Systems Research Group.
For primary bibliographic entry see Field 6B.
W77-07631

WATER RESOURCES AND WATER-SUPPLY DEVELOPMENT IN TRINIDAD AND TOBAGO,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W77-07785

HIERARCHICAL MODELING FOR THE PLANNING AND MANAGEMENT OF A TOTAL REGIONAL WATER RESOURCE SYSTEM: JOINT CONSIDERATION OF THE SUPPLY AND QUALITY OF GROUND AND SURFACE WATER RESOURCES,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
For primary bibliographic entry see Field 4B.
W77-07793

SURVEY PREDICTS 33 PERCENT MUNICIPAL COMPLIANCE WITH 1977 DEADLINE,
For primary bibliographic entry see Field 5G.
W77-07877

JOINT MUNICIPAL CORPORATION WASTE WATER TREATMENT,
For primary bibliographic entry see Field 5D.
W77-07920

3E. Conservation In Industry

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES, VOLUME I, FINANCING PACIFIC NORTHWEST ELECTRIC GENERATION,
Kell, Alterman and Runstein, Portland, Ore.
For primary bibliographic entry see Field 8C.
W77-07601

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND LICENSING PROCEDURES, VOLUME II, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES,
Kell, Alterman and Runstein, Portland, Ore.
For primary bibliographic entry see Field 6E.
W77-07602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. SELECTED MAJOR WATER USING INDUSTRIES AND POPULATION PROJECTIONS, APPENDIX III.
CH2M/Hill, Corvallis, Ore.
For primary bibliographic entry see Field 6D.
W77-07624

REVIEW OF COLOUR REMOVAL TECHNOLOGY IN THE PULP AND PAPER INDUSTRY,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
For primary bibliographic entry see Field 5D.
W77-07734

WATER RESOURCES AND WATER-SUPPLY DEVELOPMENT IN TRINIDAD AND TOBAGO,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W77-07785

HIGH GRADIENT MAGNETIC SEPARATION OF FOOD PROCESSING WASTEWATER,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5D.
W77-07852

JOINT MUNICIPAL CORPORATION WASTE WATER TREATMENT,
For primary bibliographic entry see Field 5D.
W77-07920

INDUSTRY MONITORS COUNTY STORM SEWER WATER,
Case (J. L.), Co., Racine, Wis.
For primary bibliographic entry see Field 5D.
W77-07933

COMPOSITION AND METHOD OF INHIBITING GROWTH OF SLIME IN WATER,
Betz Lab., Inc., Treviso, Pa. (Assignee).
For primary bibliographic entry see Field 5G.
W77-08027

3F. Conservation In Agriculture

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR LAKE DRAINAGE BASIN, APPENDIX I-12,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07617

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, GOOSE AND SUMMER LAKES DRAINAGE BASIN, APPENDIX I-13,
Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07618

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, KLAMATH DRAINAGE BASIN, APPENDIX I-14. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07619

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, ROGUE DRAINAGE BASIN, APPENDIX I-15. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07620

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMPQUA DRAINAGE BASIN, APPENDIX I-16. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07621

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, NORTH, MID-, AND SOUTH COAST DRAINAGE BASINS, APPENDIX I-17, AND 18. Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07622

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. IRRIGATION AND FOOD PRODUCTS PROJECTIONS, APPENDIX II. Oregon State Univ., Corvallis. Cooperative Extension Service; and Oregon State Univ., Corvallis. School of Agriculture; and Oregon State Univ., Corvallis. Agricultural Experiment Station.
For primary bibliographic entry see Field 6D.
W77-07623

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. FOREST PRODUCTS PROJECTIONS AND RECREATION PROJECTIONS, APPENDICES IV AND V. Oregon State Univ., Corvallis. Forest Research Lab.
For primary bibliographic entry see Field 6D.
W77-07625

MANUEL TECHNIQUE DU VILLAGE, (VILLAGE TECHNOLOGY HANDBOOK), (VOLS. 1 AND 2). Volunteers in Technical Assistance, Mt. Rainier, Md.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-251 094. Price codes: A19 in paper copy, A01 in microfiche. Prepared for Agency for International Development, February 6, 1976. 430 p. Translation into French from English document, Village Technology Handbook, First edition, Volumes 1, 2, 1963.

Descriptors: *Water supply, *Irrigation construction, *Irrigation design, *Irrigation systems, *Water wells, Water storage, Water purification, Concrete construction, Food processing.
Identifiers: *Village water supply, *Bamboo construction, *Refrigeration construction, *Latrine construction, Food storage, Agricultural implement construction.

This is a collection of articles which deals with the construction of various devices to improve the standards of sanitation, water supply, buildings, agriculture, and food processing in a village-level

technology; there is also a section on information dissemination. Each article contains a general description, a list of materials, complete instructions and diagrams, and predicted results. The volume also contains conversion charts and equations from English-system measures to metric measures and back. (Ward-NC)
W77-07628

SIMULATION OF IMPOUNDMENT TERRACE HYDRAULICS. Auburn Univ., Ala. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B.
W77-07767

DISPOSAL OF FEEDLOT WASTES USING A TWO-STAGE PROCESS WITH NET ENERGY PRODUCTION. Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 5D.
W77-07816

OPTIMIZATION OF WATER USE FOR IRRIGATION. North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering. J. M. Van Deman, R. S. Sowell, and R. E. Sneed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 473. Price codes: A02 in paper copy, A01 in microfiche. Paper presented at ASCE 1976 Winter Meeting, Palmer House, Chicago, Illinois, December 14-17, 1976. 20 p, 15 tab, 5 ref. Paper No. 76-2526. OWRT B-068-NC(4). 14-31-0001-4114.

Descriptors: *Agricultural water, *Water demand, *Irrigation water, *Water requirements, Irrigation, Irrigation practices, *Computer models, Linear programming, Irrigation efficiency, *North Carolina, Water utilization, Water supply, *Optimization.

Identifiers: *Agricultural water demand, Water use models, Irrigation policy, Beaufort County (NC).

A computer system has been developed for determining optimal use of a limited supply of water for the irrigation of crops. The system includes: a computer program which determines water requirements of a particular crop/soil/irrigation policy combination; a linear program; a computer program to reduce data to the input format required by MPS/360; and MPS/360 program for solution of the linear program; and a computer program to reduce the MPS/360 solutions to user oriented output reports. This system was used in a study of optimal water use in a county in eastern North Carolina. Results of the study indicate the potential of increased return from agriculture by optimally using water available for irrigation. (Kiger-NC State)
W77-07851

NITRATES IN SOME SOIL-WATER SYSTEMS IN QUEBEC, (IN FRENCH).
For primary bibliographic entry see Field 5B.
W77-07858

FLOW CONTROLLER DEVICE. Reed Irrigation Systems, El Cajon, Calif. (Assignee). M. F. Hinton, and D. Allport.
U. S. Patent No. 3,993,089, 6 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 952, No 4, p 1579, November 23, 1976.

Descriptors: *Patents, *Irrigation, *Flow control, *Irrigation practices, *Irrigation efficiency, Irrigation systems, Application equipment.
Identifiers: Drip irrigation.

In various fluid distribution systems such as drip type irrigation systems it is necessary to control the flow rate and pressure of the fluid within fairly narrow limits in order to assure proper functioning of the system. A combination shutoff, flow control and pressure relief valve that comprises a body with a movable spool and inlet and outlet portions are adapted for use with a drip irrigation system that will allow the pressure components in the system to be set at a preselected level despite the pressure of the water supply and will provide pressure controlling as well as full shut-off. Regulation of the fluid pressure in the chamber and thus in the outlet can be maintained at the preselected level by controlling the size of the inlet orifice at a point just below the actuation level of the valve spring. (Sinha-OEIS)
W77-08017

FLUID FLOW REGULATOR. Harmony Emitter Co., Inc., Tucson, Ariz. (Assignee). R. C. Harmony.
U.S. Patent No. 3,993,248, 9 p, 14 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 952, No 4, p 1632, November 23, 1976.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Flow, *Flow control, Flow system, Irrigation practices, Irrigation efficiency, Application equipment.

A primary object of the invention is to provide a fluid discharge device for an irrigation system which discharges water at a constant rate despite variations in fluid pressure. It also provides a device which will pass suspended particulate matter. The fluid flow regulator has a discharge outlet which is generally coincident with the wall of the conduit. A pair of opposed flexible elements from opposite sides of the outlet define a passageway from within the conduit to the outlet. Bias means constrict the passageway in proportion to variations in fluid pressure within the conduit. A pressure gradient within the passageway functions within the conduit so that the rate of water discharge through the outlet is maintained at constant rate despite variations in pressure within the conduit. (Sinha-OEIS)
W77-08018

IRRIGATION SYSTEM. A. J. Hieb.
U.S. Patent No. 3,993,249, 6 p, 6 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 952, No 4, p 1632, November 23, 1976.

Descriptors: *Patents, *Irrigation, *Irrigation system, *Irrigation efficiency, Irrigation practices, Sprinkler irrigation, Conveyance structures, Application equipment.

An orbital irrigation system employs a rotatable pivot head as a supply take-off which comprises a sprinkler conduit issuing horizontally from the pivot head. The sprinkler conduit includes distally placed sprinkler heads. The sprinkler conduit is carried by wheel sets placed at intervals along the length of the sprinkler conduit. The wheel sets are provided with a gear box driven by combination means for providing mechanical rotation to the gear box and for dispensing a spray of water. The sprinkler conduit has horizontal and lateral stressing including a number of spars conduit at a point distant from the pivot and over the terminal ends of the spars to alternate bases of the spars drives a carriage assembly. (Sinha-OEIS)
W77-08019

SPRINKLER ADAPTED FOR ATTACHMENT TO THE GROUND. Beatrice Foods Co., Moonachie, N.J. (Assignee). J. E. Testa.
U.S. Patent No. 3,994,441, 5 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 952, No 5, p 2043, November 30, 1976.

Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation In Agriculture

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Irrigation efficiency, Application equipment, Water distribution(Applied), Stand pipes.

One type of sprinkler has its nozzle elevated to a given height from the ground to accommodate a particular need. The size of the sprinkled area is dependent on the distance of the nozzle from the ground. Thus, given a particular water pressure, a greater area is sprinkled when the height of the nozzle is increased. In order to prevent its being tipped over easily, the base support of such a tall unit must either be relatively wide or it must be firmly fastened to something stationary and stable. The prime object of this invention is to provide a secure, rigid, and reliable attachment for securing a spike to a fluid-carrying tube in a sprinkler unit without the necessity for drilling holes in the tube. A further object is to provide a sprinkler that can be secured to the ground and having a foot-step. The nozzle is attached to one end of a fluid carrying tube. The earth-penetrating element is attached to a section at the other end by a projection-recess combination. The snugness of the fit of the projection within a recess provides a strong, rigid and reliable attachment without any need for drilling holes in the tube. (Sinha-OEIS)
W77-08025

AN INTEGRATED MODEL-APPROACH TO THE EFFECT OF WATER MANAGEMENT ON CROP YIELD.
Institute for Land and Water Management Research, Wageningen, (Netherlands).
R. A. Feddes, and A. L. M. van Wijk.
Agricultural Water Management, Vol. 1, No. 1, p 3-20, December 1976. 10 fig, 3 tab, 11 ref.

Descriptors: *Water management(Applied), Effects, *Drainage, *Simulation analysis, *Computer models, *Arable land, *Grassland, Agriculture, Seasonal, Crops, Soil moisture, Evapotranspiration, Equations, Systems analysis, *Crop production.
Identifiers: *Netherlands, Growing seasons, Integrated model approach.

A simulation model is presented which quantifies the effect of drainage on crop yield. For both arable land and grassland, the factors acting in spring, summer, and autumn are considered separately. For arable land in spring, the course in time of the soil water tension of the upper layer is simulated in terms of rainfall, evaporation, drain depth, and drain intensity data; the dates and number of workable days are established from model output. The expected yield depression is then derived, using an experimental relationship between yield depression and number of days of sowing delay. During summer, the yield can be obtained from the relationship between yield and relative evapotranspiration. Combining this yield, obtained using a known evapotranspiration model, with the yield depression, objected by means of the workability model used in the above example for spring, gives the actual yield. For autumn, the workability model determines the dates and number of days available for harvesting. Yields are derived from an experimental relation between yield depression and the number of days of earlier harvesting. An example is given for summer cereals growing on heavy sandy loam soil in the Netherlands. For grassland, the effect of shallow groundwater table depths in winter and spring on the yield of the first and second cut can be determined using the workability model. Combining the yield depression with the yield obtained with the evapotranspiration model gives the actual yield. An example representative for the Netherlands is given for grass on peat soil. (Bell-Cornell)
W77-08038

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

OPERATING POLICY ADAPTATIONS FOR A RESERVOIR SYSTEMS, (PHASE I),
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
G. H. Toebes, and C. Rukvichai.
Purdue University Water Resources Research Center, Technical Report No. 79, August 1976. 72p.

Descriptors: *Reservoir Operation, *Reservoir releases, Simulation analysis, Management, Water policy, Model studies, Kentucky, Algorithms, Data collections.
Identifiers: *Green River Basin(KY), *Dam tender reports, Operating policy algorithm, Reservoir regulation rules, *Operating policy.

Daily reservoir regulation records in the form of historical daily releases, Qht(cfs), were constructed for the four Corps of Engineers reservoirs in the Green River Basin, KY. The Qht time series were constructed from the daily Dam Tender Reports for the Barren, Green, Nolin, and Rough River Reservoirs, KY. The Qht-values were compared on a day-by-day basis with the release decisions, Qt, yielded by an operating policy algorithm based on the official Reservoir Regulation Schedules. These schedules are merely guides and will, in practice, be supplemented by various rules and practices. An attempt was made to capture these practices in an operating policy algorithm. The building of the models to obtain Qht, Qt, and the various exogenous data series needed by the operating policy algorithm. The building of the models to obtain Qht, Qt, and the various exogenous data series needed by the operating policy algorithm, constitutes the major aspect of the work reported herein. An initial analysis of the results, mainly in the form of daily flow deviation series, Qht-Qt, for up to eight years and four reservoirs has provided considerable insight into the many practical constraints associated with the operation of an actual reservoir system. This is of value to researchers in reservoir systems analysis. Further analysis involving interviews with COE staff are needed to exploit all the computed data series. Initial analysis points to possible improvements in computer assisted operations of reservoir systems. (See also W77-07604)
W77-07603

OPERATING POLICY SIMULATION OR A RESERVOIR SYSTEMS, (PHASE II),
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
G. H. Toebes, C. Rukvichai, and Y. S. Lin.
Purdue University Water Resources Research Center, Technical Report No. 80, August 1976. 104p, 7 ref, 5 append.

Descriptors: *Reservoir operation, *Reservoir releases, Algorithms, Simulation analysis, Regulation, Data collections, Model studies, Kentucky, Data processing.
Identifiers: *Green River Basin(KY), *Dam tender reports, *Operating policy algorithm, Reservoir inflow models, Regulation schedules.

The large amount of data needed in constructing the Operating Policy Algorithm reported in PWRRC Report no. 79 required the construction of a Data Base and its associated access routines. Among the data used as input to the Operating Policy Algorithm are the reservoir inflow predictions. These are generated by Reservoir Inflow Models. An initial analysis of the obtained 'deviation series, $\Delta Q = Q_{ht} - Q_t$, for up to eight years and

four reservoirs has provided considerable insight into the many practical constraints associated with the operation of an actual reservoir system. A general discussion and interpretation of results is found in a companion publication (PWRRC no. 79). This report amplifies the following: (a) Data Acquisition, Data Base construction, and the mode of Data Base use, (b) Algorithm for converting Dam Tender Reports into reservoir outflow and storage time series, (c) Construction of one of the Reservoir Inflow Models, (d) Construction of the Operating Policy Algorithm. Sufficient detail has been provided to extend the work along the lines set forth in PWRRC Report no. 79. (See also W77-07603).
W77-07604

GENERATION OF MULTIVARIATE SYNTHETIC FLOWS,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 2A.
W77-07610

FLOODFLOW FORMULAS FOR URBANIZED AND NONURBANIZED AREAS OF CONNECTICUT,
Geological Survey, Hartford, Conn. Water Resources Div.
For primary bibliographic entry see Field 4C.
W77-07612

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER PROTECTION OF AREAS OF ORIGIN, APPENDIX VII,
Wendell and Schwan, Washington, D.C.
For primary bibliographic entry see Field 6D.
W77-07627

AN ANALYSIS OF ALTERNATIVE FLOOD MANAGEMENT PLANS IN UPSTREAM WATERSHEDS. CONNECTICUT RIVER BASIN SUPPLEMENTAL FLOOD MANAGEMENT STUDY, PHASE 2,
Soil Conservation Service, Durham, N.H.
For primary bibliographic entry see Field 6F.
W77-07632

FLOOD PLAIN INFORMATION: THOMPSONS CREEK AND TRIBUTARIES, BRYAN, TEXAS,
Army Engineer District, Fort Worth, Tex.
Prepared for the City of Bryan, December 1975, 41 p, 7 fig, 23 plates, 7 tab.

Descriptors: *Texas, Floods, Flooding, *Flood flow, *Flood forecasting, *Flood profiles, *Flood data, *Peak discharge, *Flood plains, Storms, Historic floods, Flood frequency, Flood stages, Flow characteristics, Flood protection, Non-structural alternatives, Flood plain zoning, Flood plain insurance, Building codes, Zoning, Control structures, Standard Project Flood.
Identifiers: Bryan(TX), *Thompsons Creek(TX), Thompsons Branch(TX), Still Creek(TX), West Fork Still Creek(TX), Cottonwood Branch(TX), South Fork Cottonwood Branch(TX), 10-year flood, 50-year flood, 100-year flood, 500-year flood.

The report covers 33.8 miles of channel of Thompsons Creek and its tributaries in the vicinity of Bryan, Brazos County, Texas. The tributaries include Thompsons Branch, Still Creek, West Fork Still Creek, Cottonwood Branch and South Fork Cottonwood Branch. Thompsons Creek drains 54 square miles. The flood plains are largely undeveloped and sparsely populated, with some residential, commercial and light industrial development in the upper reaches of Cottonwood Branch and Still Creek. Floods result from heavy rains in spring and fall, usually associated with frontal type storms, tropical hurricanes and thunderstorms. No stream gaging stations are main-

tained in the watershed. Data were obtained from U.S. Geological Survey records. Little specific data are available on past floods. There are no major flood damage prevention measures in the study area at this time. Peak discharge at the mouth of Thompsons Creek for a 50-year, 100-year and 500-year flood are 20,700 cubic feet per second (cfs), 24,500 cfs, and 34,800 cfs respectively. The discharge of a 100-year flood on Thompsons Branch, Still Creek, West Fork Still Creek, Cottonwood Branch and South Fork Cottonwood Branch is 5,800 cfs, 12,500 cfs, 1,280 cfs, 6,300 cfs, respectively. Channel velocities on Thompsons Creek for a 100-year flood are 2.0 to 6.0 feet per second, and 0.7 to 3.0 ft/sec in the overbank areas. Guidelines for flood plain management are discussed, including flood plain management tools such as zoning and subdivision control ordinances, building and health codes and several non-regulatory methods. (Gentry-NC)
W77-07634

FLOOD PLAIN INFORMATION; SAN ANTONIO RIVER, BEXAR COUNTY, TEXAS.
Army Engineer District, Fort Worth, Tex.
Prepared for the San Antonio River Authority, June 1975, 36 p, 7 fig, 19 plates, 7 tab.

Descriptors: *Texas, Floods, Flooding, *Flood flow, *Flood profiles, *Peak discharge, *Flow duration, Flow characteristics, *Flood plains, *Flood plain zoning, Dams, *Channel improvement, Streamflow forecasting, Flood forecasting, Storms, Hurricanes, Historic floods, Flood data, Flood frequency, Flood protection, Non-structural alternatives, Flood plain insurance, Building codes, Control structures.
Identifiers: *San Antonio River(TX), Bexar County(TX), San Antonio(TX), 50-year flood, 100-year flood, 500-year flood, Olmos Dam.

The report covers 22.3 miles of the San Antonio River near San Antonio, Texas, in Bexar County. The source of the San Antonio River lies within the city limits of San Antonio. The river slope averages 9.7 feet per mile. Development in the flood plain consists mainly of agriculture. Most floods occur in the fall resulting from hurricanes and thunderstorms. Flood control measures include the San Antonio Channel Improvement Project, the Olmos Dam, and land use controls, building codes and subdivision regulations. Stream gaging stations have been maintained by the U.S. Geological Survey at various locations in the study area, the longest one being for 53 years. Data were obtained from records of these gages, and also from precipitation records, newspapers and historical documents and records. Significant floods on the San Antonio River occurred in 1921, 1931, 1946, 1963, 1968 and 1973, the largest being the 1921 flood with a discharge at the San Antonio gage of 15,300 cubic feet per second (cfs). Peak discharge on the San Antonio River at the Bexar County line for a 50-year, 100-year, and 500-year flood are 79,900 cfs, 111,100 cfs and 227,000 cfs, respectively. During a 100-year flood, the river would rise at a rate of 7.9 feet per hour, cresting at one foot above bankfull and remain above bankfull for 14 hours. Guidelines are presented for land use in the river basin, with discussion of non-structural controls such as flood plain zoning, subdivision control, building and health codes, and others. (Gentry-NC)
W77-07635

SPECIAL FLOOD HAZARD REPORT: JERSEY CREEK, KANSAS CITY, KANSAS.
Army Engineer District, Kansas City, Mo.
Prepared for City of Kansas City, KS. December 1969, unpag, 2 fig, 4 plates.

Descriptors: *Kansas, *Floods, *Flood plains, Flooding, Regional flood, Flood flow, Streamflow forecasting, Historic floods, Flood data, Peak discharge, Flood damage, Obstructions to flow, Velocity.

Identifiers: *Jersey Creek(KS), *Kansas City(KS), Standard Project Flood, Intermediate Regional Flood.

Though Jersey Creek flows through heavily populated sections of Kansas City, actual developments in the flood plains of the stream are rather limited, but do include some industrial areas, commercial and residential development, railroads and highways. The Jersey Creek basin has a drainage area of 5.42 sq mi, all within the city limits. The flood plain averages 200 to 400 feet wide. The main stem channel is well incised with a rather steep bed slope of 28 feet per mile. In contrast, tributary areas entering from the south are served by swale type surface drainage with no identifiable channels. There is no stream gaging station on this creek, but reports indicate floods occurred in 1906 and 1969. The 1969 event resulted from a storm which deposited from 6 to 8.5 inches of rain over the basin. Overflow from this storm was not observed at any point along the main channel or on tributaries having well developed channels. Flooding did occur on tributaries with swale type drainage. Businesses and streets were inundated. In the event of an Intermediate Regional Flood (IRF), Jersey Creek would have a peak discharge of 5,900 cfs, along with water velocities of 3 to 5 ft/sec. In a Standard Project Flood (SPF) a peak discharge of 10,700 cfs is predicted, and water velocities of 4 to 8 ft/sec. Tributaries to Jersey Creek would have smaller peak discharges. Many of the bridges in the area would be obstructive to flood flow. No information is given in this report on any flood control methods which may have been taken in this area. (Smith-North Carolina)
W77-07636

FLOOD PLAIN INFORMATION, SOUTH ANNA RIVER, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
Prepared for Hanover County, VA, July 1976, 27 p, 7 tab, 9 fig, 28 plates.

Descriptors: *Floods, *Flood data, *Flood control, *Historic floods, *Maximum probable flood, *Virginia, Flood peak, Flood protection, Building codes, Flood plains, Flood damage.
Identifiers: *South Anna River(VA), Hanover County(VA), 100-year flood, 500-year flood, Richmond(VA).

The study area includes approximately 36 miles of the South Anna River in Hanover County, VA. This stretch of river drains approximately 287 square miles of land. There is little development on the flood plain, but the close proximity of the expanding Richmond urban area makes future development likely. Flood data dating back to 1930 were obtained from a U.S. Geological Survey stream gage near Ashland, U.S.G.S. 1:24,000 scale topographic sheets, and precipitation records. Supplementary data were obtained from newspaper files and historical documents. Floods occur at any time of year and are caused by intense short term rainfall or tropical disturbances. The worst flood of record occurred on August 23, 1969, discharging 17,100 cubic feet/sec (cfs) and cresting at 108.73 feet mean sea level (MSL), which is 12.99 feet above flood stage. Flood damages exceeded \$250,000. The 500-year flood is expected to crest at 115.4 MSL and discharge 31,000 cfs at the U.S.G.S. gage station; the 100-year flood will crest at 109.8 feet MSL, and discharge 19,000 cfs. Some existing residential property would be damaged by these floods. There are no existing or planned flood control structures that affect the 100- or 500-year flood. The statewide building code requires protection of buildings from the 100-year flood. The report does not provide solutions to flood problems, but provides a basis for adoption of land use controls to guide future flood plain development. (Nessa-NC)
W77-07637

FLOOD PLAIN INFORMATION, NORTH ANNA RIVER, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
Prepared for Hanover County, VA, July 1976, 27 p, 7 tab, 26 plates, 8 fig.

Descriptors: *Floods, *Flood data, *Flood control, *Historic floods, *Maximum probable flood, *Virginia, Flood peak, Flood protection, Building codes, Flood plains, Flood flows, Flood damage.
Identifiers: *North Anna River(VA), Hanover County(VA), 100-year flood, 500-year flood.

The study area includes approximately 50 miles of the North Anna River in Hanover County, VA, which drains 597 square miles of land. The flood plain consists mostly of wooded areas and open space, but development within the watershed is rapid and could soon impinge on the flood plain. Flood data dating back to 1927 were obtained from a Virginia State Water Control Board stream gage, U.S. Geological Survey 1:24,000 scale topographic sheets, and precipitation records. In addition, high water marks were obtained following the floods of August 1969 and June 1972. Although the highest flood of record (August 12, 1928) crested at 89.36 feet mean sea level (MSL), which is 20.7 feet above flood stage, its discharge of 18,400 cubic feet/sec (cfs) has been exceeded by recent floods with lower crests. The flood of August 24, 1969 crested at 88.26 MSL (19.6 feet above flood stage), discharging 24,800 cfs, and the flood of June 22, 1972 crested at 87.24 feet MSL (18.6 feet above flood stage), discharging 23,300 cfs. The 500-year flood will crest at 95.47 feet MSL and discharge 45,000 cfs at the existing gage. The 100-year flood will crest at 88.57 feet MSL and discharge 25,500 cfs. There are no existing or planned flood control structures that would affect the 100- or 500-year floods. The statewide building code requires protection of buildings from the 100-year flood. The report does not provide solutions to flood problems, but provides a basis for adoption of land use controls to guide future flood plain development. (Nessa-NC)
W77-07638

FLOOD PLAIN INFORMATION, CHERRY CREEK-CHERRY CREEK LAKE THROUGH FRANKTOWN, COLORADO.
Army Engineer District, Omaha, Nebr.
Prepared for Arapahoe County, Douglas County, Urban Drainage and Flood Control District, Colorado Water Conservation Board, October 1976, 40 p, 6 tab, 13 fig, 54 plates.

Descriptors: *Floods, *Flood data, *Flood control, *Flood plain zoning, *Flood profiles, Non-structural alternatives, *Colorado, Historic floods, Flood protection, Maximum probable flood, Flood plains, Flood peak.
Identifiers: *Cherry Creek(CO), Franktown(CO), Parker(CO), Douglas County(CO), Arapahoe County(CO), 100-year flood, 500-year flood.

The study area includes approximately 20 miles of Cherry Creek from about 7 miles downstream from Parker to about 2.5 miles upstream from Franktown in Douglas and Arapahoe Counties, CO. Development on the flood plain is primarily agricultural, with more congested urban development remaining external to the flood plain. The close proximity of the expanding Denver urban area makes future development on the flood plain likely. Flood data were obtained from two stream gages maintained by the U.S. Geological Survey, one near Parker, from 1933 to 1969 with a few interruptions, and one near Franktown since 1939. Earlier information was obtained from Corps of Engineers flood records. The main flood season occurs from May to August and results from either heavy general rainfall or intense local storms. The greatest recorded flood flow at the Franktown gage occurred on August 5, 1945, discharging 9,170 cubic feet/sec (cfs). The greatest recorded flood flow at the Parker gage occurred on June 16, 1965, discharging 39,900 cfs. The 100-year flood is

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Group 4A—Control Of Water On The Surface

expected to discharge 13,300 cfs at the Franktown gage and 51,000 cfs at the Parker gage. The 500-year flood is expected to discharge 63,000 cfs at the Franktown gage and 150,000 cfs at the Parker gage. Damages from floods having a once in 25 year probability or less are unlikely due to 32 floodwater retarding structures completed in 1965 by the Soil Conservation Service. Flood plain zoning and other non-structural alternatives could minimize damages from larger floods. (Nessa-NC) W77-07639

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, WARREN COUNTY, PENNSYLVANIA, Army Engineer District, Pittsburgh, Pa. Prepared for Warren County Planning Commission and the Pennsylvania Department of Environmental Resources, June 1975, 29 p, 13 fig, 17 plates, 5 tab.

Descriptors: *Pennsylvania, *Floods, Flooding, *Flood profiles, *Historic floods, *Flood stages, *Peak discharge, Flood flow, Streamflow forecasting, Flood frequency, Flow duration, Flow characteristics, Ice jams, Control structures, Dams, Reservoirs. Identifiers: *Warren County(PA), *Allegheny River, 100-year flood, 500-year flood, Warren(PA), Tidioute(PA), Kinzua Dam(PA).

The report concerns flooding of the 37.4 mile segment of the Allegheny River lying within Warren County located in northwestern Pennsylvania. Warren and Tidioute are the main towns in the County. The bed slope of the Allegheny River within Warren County averages 3.6 feet per mile, with valley floor widths ranging from 0.1 to 0.6 mile. The Kinzua Dam has reduced flood threats so that camps, trailer parks and industrial sites are now being developed on what was previously marginal land. Flood flow data were obtained from U. S. Geological Survey, National Weather Service, and U. S. Army Corps of Engineers stream gages, including one in Warren established in 1884. In addition, records were obtained from newspapers and historical documents. Main flood season is December through April. The most recent high flood occurred on March 8, 1956, reaching a gage height of 18.3 feet at the Warren gage and discharging 80,500 cubic feet per second (cfs). Ice jams have historically caused unpredictable rises in river stage. Peak discharge for a 100-year flood (Intermediate Regional Flood) is 40,000 cfs and 46,500 cfs for a 500-year flood. Channel velocities for 100-year and 500-year flood would be 4.4 and 4.8 ft/sec, respectively. The 100-year flood would crest in 24 hours while the time of rise for a 500-year flood would be 30 hours. (Gentry-NC) W77-07640

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, VENANGO COUNTY, PENNSYLVANIA, Army Engineer District, Pittsburgh, Pa. Prepared for Venango County Planning Commission and the Pennsylvania Department of Environmental Resources, December 1974, 33 p, 12 fig, 16 plates, 7 tab.

Descriptors: *Pennsylvania, *Floods, Flooding, Flow characteristics, *Peak discharge, *Flood plains, Flood flow, Streamflow forecasting, Flood forecasting, Historic floods, Flood data, Flood frequency, Flow duration, Flood damage, Channels, Flood protection, Control structures, Dams, Reservoirs, Standard Project Flood. Identifiers: *Allegheny River, Venango County(PA), Kinzua Dam(PA), Oil City(PA), Franklin(PA), Tionesta Dam(PA), Union City Dam(PA), Woodcock Dam(PA), Intermediate Regional Flood.

The study covers the 60 miles of the Allegheny River lying within Venango County (PA). The average bed slope of the Allegheny River in the study reach is 3.0 ft/mile, with valley floor widths

ranging from 0.1 to 0.4 miles. Residential and industrial development in the flood plain is concentrated at Franklin (PA) and Oil City (PA). Data were obtained from U. S. Geological Survey records for stream gaging stations maintained at Parker, Franklin, and West Hickory (PA). Newspaper files and historical records and documents were used to supplement these data. The main flood season is December through April, resulting from heavy rainfall and snowmelt. Four upstream dams have been built to control floods—Tionesta Dam, Kinzua Dam, Union City Dam, and Woodcock Dam. The highest known flood occurred on March 17, 1865, cresting at 25 feet at the Franklin gage. Ice gorges caused a higher crest in February 1917–26 feet. Since the completion in 1967 of the Kinzua Dam, only an ice jam in 1970 has exceeded a stage of 20 feet. Peak discharge for an Intermediate Regional Flood (IRF) and Standard Project Flood (SPF) are 120,000 cubic feet per second (cfs), and 157,000 cfs, respectively. For an IRF and SPF, the channel and overbank velocities are 12 and 14 ft/sec, and 4.0 and 4.0 ft/sec, respectively. An IRF should crest after 24 hours, remaining 0.5 days above bankfull. An SPF should crest in 30 hours and be above bankfull for 1 day. There are no significant obstructions to flood flow. (Gentry-NC) W77-07641

FLOOD PLAIN INFORMATION: NORTHWEST STREAM GROUP, STOCKTON, CALIFORNIA, Army Engineer District, Sacramento, Calif. Prepared for San Joaquin County, CA, July 1976, 43 p, 11 tab, 21 fig, 19 plates.

Descriptors: *Floods, Flooding, *Flood data, *Tidal waters, *Peak flows, *California, Flood control, Flood frequency, Flood damage, Flood plain zoning, Flood plains, Historic floods, Flood protection, Standard Project Flood, Levees, Reservoirs, Flood profiles, Storms, Winds. Identifiers: *Stockton(CA), San Joaquin County(CA), *San Joaquin River(CA), Bear Creek(CA), Lower Mosher River(CA), Disappointment Slough(CA), Fourteen Mile Slough(CA), Calaveras River(CA), Intermediate Regional Flood.

The study area involves six streams and waterways in Stockton and San Joaquin County, California. The rivers involved are the San Joaquin, Bear Creek, Lower Mosher, Disappointment slough, Fourteen Mile Slough, and the Calaveras River. They are the termini of a complex system of waterways draining a relatively small watershed. These rivers and streams cause flooding in the Stockton area; tidal action also causes flooding. The area is very flat, and is consequently very susceptible to flooding. Development in flood-prone areas is extensive, ranging from agriculture to residential and commercial buildings. Flood data were obtained from 15 stream gaging stations and 7 tide gaging stations, numerous precipitation stations, U. S. Geological Survey (USGS) topographic maps, and newspaper files. General rain floods occur from November through April, while snowmelt floods occur from April through June. The most severe floods result when very high tides and strong onshore winds occur coincidentally with flood periods. The worst flood in the recorded history of the central valley occurred in December 1955. A portion of stockton was inundated. Flood water reached 3 feet and covered an area over 2 miles wide. Damage totaled over \$1.5 million. Another large flood occurred in April 1958. Several reservoirs and extensive levees exist, and further-reaching flood plain zoning and other land use control measures will all contribute to minimizing the impact of the Standard Project Flood. The Intermediate Regional Flood would only affect small agricultural areas. The report does not contain plans or recommend action for flood control. (Nessa-NC) W77-07642

FLOOD PLAIN INFORMATION: WICHITA RIVER AND TRIBUTARIES, WICHITA FALLS, TEXAS, Army Engineer District, Tulsa, Okla. Prepared for City of Wichita Falls, May 1976, 40 p, 11 fig, 21 plates, 5 tab.

Descriptors: *Texas, *Floods, Flooding, *Flood forecasting, *Flood profiles, *Peak discharge, Flow characteristics, *Flood plains, Flood flow, Historic floods, Flood data, Flood frequency, Flood peak, Flow duration, Flood damage, Channels, Flood protection, Non-structural alternatives, Flood plain zoning, Building codes, Land use, Zoning, Dams, Reservoirs, Water storage, Standard Project Flood, Control structures. Identifiers: *Wichita River(TX), Pond Creek(TX), East Fork Pond Creek(TX), *Wichita Falls(TX), Beaver Creek, Buffalo Creek, Plum Creek, Intermediate Regional Flood.

The study covers the Wichita River, and Pond and East Fork Pond Creeks, draining altogether approximately 3,349 square miles, in the vicinity of Wichita Falls, TX. Lake Kemp, on the Wichita River, had flood control storage capacity so that emphasis is placed on the 41.3 mile segment of Wichita River below the lake, and the river's tributaries which include Beaver creek, Buffalo Creek, Pond Creek and Plum Creek. The average streambed slope for the Wichita River in the study area is 1.3 feet per mile, and 5.8 and 7.7 ft/mi for Pond and East Fork Pond Creeks, respectively. Floods result from thunderstorms and frontal movements, occurring most frequently from May through October. Data were obtained from a U. S. Geological Survey stream gaging station located near the center of the study area, and other information was obtained from local records and field investigation. A flood in October 1941 was the largest since gage records have been kept, with a discharge of 17,800 cubic feet per second (cfs). Peak discharge for the Intermediate Regional Flood and Standard Project Flood on the Wichita River, Pond Creek and East Fork Pond Creek are 24,800 and 70,500 cfs, 4,790 and 10,108 cfs, and 3,036 and 6,486 cfs, respectively. Main channel velocity during an IRF for Wichita River, Pond Creek and East Fork Pond Creek is 4.0 feet per second, 5.86 ft/sec and 4.17 ft/sec, respectively. Guidelines for flood plain management are discussed, including non-structural alternatives such as zoning, subdivision and health regulations, and building codes. (Gentry-NC) W77-07643

FLOOD PLAIN INFORMATION: IPSWICH RIVER, NORTH READING AND WILMINGTON, MASSACHUSETTS, Army Engineer District, Waltham, Mass. New England Div. Prepared for the Towns of North Reading and Wilmington, September 1971, 58 p, 9 fig, 6 plates, 8 tab.

Descriptors: *Floods, Flood stages, Flood plains, Channel improvement, *Flood plain zoning, *Swamps, *Massachusetts, *Flood profiles, Flooding, Historic floods, Flood data, Peak discharge, Flow duration, Flow characteristics, Flood damage, Flood protection, Zoning, Planning. Identifiers: *Ipswich River(MA), North Reading(MA), Wilmington(MA), Intermediate Regional Flood, Standard Project Flood.

The study area of the Ipswich River, located in Northeastern Massachusetts, covers 13.3 miles between the towns of Wilmington and North Reading. Meandering in a northeasterly direction, the river drains 43.4 sq mi above the study area and slopes at an average of 3 ft/mi. The flood plain, consisting of much fill, contains residential, commercial and industrial development with continued development taking place in flood-prone areas. Flooding occurs in the spring, resulting from a combination of heavy rains and melting

snow. High flood stages are the result of storms which produce large volumes of runoff rather than high intensity, low duration storms. Particular to Ipswich River Basin are the swamp systems which function as huge reservoirs and reduce peak storm runoff by temporarily impounding large volumes of water. No flood control measures exist except for minor channel improvement, but the local governments have enacted Flood Plain Zoning Ordinances. The greatest flood occurred on March 19, 1968 with a flood level of 7.09 ft and an estimated peak discharge of 833 cubic ft/sec. Damage in a 1962 flood was well over \$100,000. An Intermediate Regional Flood would have a peak discharge of 1,100 cfs, a 1 foot stage higher than 1968 flood. A Standard Project Flood would have peak discharge of 1,500 cfs and a stage 2.5 higher than the 1968 flood. (Salzman-North Carolina). W77-07644

FLOOD PLAIN INFORMATION: MERRIMACK AND SOUHEGAN RIVERS, LITCHFIELD AND MERRIMACK, NEW HAMPSHIRE.
Army Engineer District, Waltham, Mass.
October 1973. 28 p, 13 fig, 9 plates, 6 tab.

Descriptors: *Floods, Flooding, *Peak discharge, Flow characteristics, *Flood plains, *Flood protection, Control structures, Dams, Historic floods, Flood data, Flood stages, Flow duration, Rivers, Planning, Diversion structures, *New Hampshire. Identifiers: *Merrimack River(NH), *Souhegan River(NH), Litchfield(NH), Merrimack(NH), Intermediate Regional Flood, Standard Project Flood.

The Merrimack River, located in South Central NH, flows southeasterly in this study area for 9 miles, sloping at an average of .84 ft per mile. Its flood plains range from .1 to 1 mile wide and contain primarily agricultural areas with some residential, commercial and industrial development. The Souhegan River flows in an easterly direction for 7.5 miles in study area, sloping at 12.4 ft per mile. Varying from 200 ft to 3400 ft wide, its flood plains are mostly agricultural and wooded. Both flood plains are under pressure for development. Major floods, caused by runoff from general rainfall, occur during all seasons. Other causes include hurricane activity and snowmelt. Flood flow stages rise in a relatively short period of time with high velocities (10 to 15 ft per sec) in channel. Eleven of 13 proposed flood retarding structures have been built on the Souhegan River. To maintain flood control and low flow augmentation, 5 dams have been constructed on the Merrimack. Greatest known flood on the streams occurred March 19-20, 1936 with a peak discharge of 173,000 cubic ft/sec on the Merrimack. An Intermediate Regional Flood and Standard Project Flood on the Merrimack would result in peak discharges of 102,000 cfs and 142,000 cfs, respectively. Similar flood conditions would exist on the Souhegan River, though with discharge of 22,000 and 12,500 cfs for the SPF and IRF, respectively. This report furnishes a suitable basis for the adoption of land use controls to guide flood plain development. (Salzman, North Carolina) W77-07645

THE REPRESENTATION OF A SHORT PERIOD OF EXPERIMENTAL CATCHMENT DATA BY A LINEAR STOCHASTIC DIFFERENCE EQUATION.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2.
W77-07646

INVESTIGATIONS ON THE STRUCTURE OF FREQUENCY DISTRIBUTIONS OF FLOODS.
Technische Universitaet, Dresden (East Germany).
For primary bibliographic entry see Field 2E.
W77-07649

BAYESIAN ESTIMATION OF FREQUENCY OF HYDROLOGICAL EVENTS.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W77-07650

STOCHASTIC STRUCTURE OF A PROCESS OF AVERAGE MONTHLY FLOWS.
Technical Univ. of Warsaw (Poland).
For primary bibliographic entry see Field 2E.
W77-07651

SPATIAL AND TIME ANALYSIS AND ESTIMATION OF RIVER FLOW.
Moscow State Univ. (USSR). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W77-07654

THE GENERATION OF SYNTHETIC MONTHLY RUNOFF RECORDS FOR UN-GAUGED BRITISH CATCHMENTS.
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-07661

STOCHASTIC DIFFERENCE EQUATION MODELLING OF HYDROLOGICAL PROCESSES.
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-07663

SIGNIFICANCE TESTS OF PERIODICITY IN HYDROLOGICAL TIME SERIES.
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-07665

MATHEMATICAL MODELS RESULTING FROM STATISTICAL ANALYSIS OF THE MEAN MONTHLY FLOW.
Ebasco Services, Inc. New York.
For primary bibliographic entry see Field 2E.
W77-07669

DETERMINATION OF THE DEGREE OF PROTECTION OFFERED BY FLOOD CONTROL SYSTEMS ON THE BASIS OF DISTRIBUTION FUNCTIONS.
Water Resources Centre, Budapest (Hungary).
For primary bibliographic entry see Field 8B.
W77-07673

A MULTIVARIATE MATHEMATICAL MODEL OF MONTHLY RIVER FLOW.
Asian Inst. of Tech., Bangkok (Thailand). Div. of Water Science and Engineering.
For primary bibliographic entry see Field 2E.
W77-07675

TIME AND FREQUENCY-DOMAIN IDENTIFICATION OF A CASUAL BIVARIATE STOCHASTIC PROCESS.
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2E.
W77-07680

APPLICATION OF STOCHASTIC HYDROLOGICAL MODELS IN THE DESIGN OF LAKE LEVEL CONTROL.
Technical Univ. of Budapest (Hungary). I. Kontur.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland.

Volume 1, July 1971. IAHS/Unesco, Paris, France, 1974, + 379-384.

Descriptors: *Lakes, *Hydrologic systems, Water demand, *Water levels, *Simulation analysis, Control, Design, Correlation analysis, Water balance, Digital computers, Inflow, Outflow, Meteorology, Economic efficiency, Probability, Monte Carlo method, Equations, Systems analysis, Mathematical models.
Identifiers: *Lake levels, *Lake Balaton, Hungary.

Reported is an analysis made of the hydrological system of Lake Balaton, the largest lake of Central and Western Europe. The analysis was made in order to yield data for the preliminary design of structures that are to serve the control of lake level and the meeting of various water demands. The economy and the future operation method of the structures to be built were studied using simulation. When analyzing long series consisting of annual and monthly data of hydrometeorological elements observed at stations at and near the shores of Lake Balaton, use was made of correlation analysis, the function of the sum of quadratic differences, and spectrum analysis, and seven types of relationships have been established. The analysis of time sequences has proved the inhomogeneity of long sequences and an attempt was therefore made to derive results from intensive analysis of data from recent times and from generated data. The water balance equation of the lake and basin was used to produce a data sequence of water content changes, based upon the various elements of water balance, using various methods. A method of generating simultaneous data sequences with the appropriate cross-correlation structure has been proposed; simulation runs were made on a digital computer and the range of water stage fluctuations has been established for various control rules on inflow and outflow. (See also W77-06708) (Bell-Cornell)
W77-07681

SOME ARITHMETICAL RELATIONS OF A MATRIX FOR A CALCULUS OF RESERVOIRS, (QUELQUES RELATIONS ARITHMETIQUES DE MATRICE DANS LE CALCUL DES RESERVOIRS).
Direction des Eaux, Baja (Hungary).

I. Zsuffa.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Volume 1, July 1971. IAHS/Unesco, Paris, France, 1974, p 385-394. 2 fig, 7 tab, 6 ref.

Descriptors: *Reservoirs, *Optimum development plans, *Dimensions, *Probability, Water demand, Discharge(Water), Computer programs, Equations, Mathematical models, Systems analysis.
Identifiers: Reservoir capacity.

When planning the optimum dimensions of a reservoir, the so-called reservoir characteristic curves showing the relations between reservoir capacity K, water demand M, and the probability of occurrence P should be plotted. Dividing the ranges K, M and V, to the tenths of the mean discharge (V stands for the natural annual discharge), the "transition probability matrix" belonging to all $K=k$ and $M=m$ pairs of data can easily be plotted on the basis of the fundamental matrix derived from the values of the distribution function of the natural discharges. In this way, the computer quickly gives the points of the reservoir characteristic curves by means of a simple program; furthermore, vectors show the probabilities of occurrence of the contents of the reservoir having the capacities $K=k$ and the demands for water $M=m$. The product obtained by the matrices consisting of these vectors and by the matrix composed of the values of the distribution function to the natural discharges will give the distribution function of the water quantities discharging through the spillway. For the calculus of a system consisting of two reservoirs a comparatively simple

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three-dimensional matrix should be composed. (See also W77-06708) (Bell-Cornell) W77-07682

EMPTINESS OF A FINITE DAM—TIME DEPENDENT THEORY,
Indian Inst. of Tech., Madras. Dept. of Mathematics;
For primary bibliographic entry see Field 8B. W77-07683

MULTIPLE MARKOV PROCESSES IN HYDROLOGY AND THEIR IMPORTANCE FOR STOCHASTIC ANALYSIS OF WATER ACCUMULATION PROBLEMS,
Technical Univ. of Prague (Czechoslovakia). K. Nachazel.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July, 1971, Volume 1. IAHS/Unesco, Paris, France, 1974, p 401-407. 3 fig, 5 ref.

Descriptors: *Markov processes, *Reservoirs, *Reservoir storage, Evaluation, Design, Hydrology, Rivers, Runoff, Inflow, Correlation analysis, Equations, Systems analysis, Mathematical models.
Identifiers: *Random flow, *Long-term storage, Statistical parameters.

This study considers the possibility of using composed Markov chains for mathematical modeling of random flow series, given statistical parameters. Evaluated is their importance for the design of storage reservoirs for long-term usage. A comparative analysis is made with the existing assumption where the flow series are expressed as random series or a simple Markov chain. From the resulting solution it is seen that the use of Markov chains of higher order leads to more economical design of water storage reservoirs for long-term usage. In addition to the statistical parameters of the distribution function, the internal structure of the flow series expressed by the correlation function also influences the size of the long-term storage reservoirs. The statistical qualities of flow series are therefore to be checked by detailed analyses in each given case. (See also W77-06708) (Bell-Cornell) W77-07684

MATHEMATICAL MODELS OF RUNOFF FOR THE COMPUTATION OF STORAGE RESERVOIRS,
Tbilisskii Gosudarstvennyi Universitet (USSR). Dept. of Hydrology.
G. G. Svanidze.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 1. IAHS/Unesco, Paris, France, 1974, p 408-413. 1 fig, 14 ref.

Descriptors: *Reservoirs, *Reservoir storage, *Runoff, *River regulation, Water resources, Monte Carlo method, Stochastic processes, Hydrology, Probability, Markov processes, Equations, Mathematical models, Systems analysis.

A study of the regime of river runoff and its regularities has been conducted for purposes of rational water resources utilization and the control of floods. Calculations for the two basic cases of river runoff regulation (for both static and dynamic regimes) are systematized. A scheme is given for the selection of one-dimensional probability distribution. The most general distribution laws (limited on both sides) are indicated for most of the rivers. A unified method is set forth for modeling both unconditional and conditional realizations of river runoff. (See also W77-06708) (Bell-Cornell) W77-07685

MODEL OF A LAKE RESERVOIR,
Wasserwirtschaftsdirektion, Halle, (East Germany). E. Weber.
In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971. IAHS/Unesco, Paris, France, 1974, p 422-427. 5 fig, Volume 1.

Descriptors: *Lakes, *Reservoirs, *Monte Carlo method, *Simulation analysis, *Reservoir operation, Water supply, Flood control, Stochastic processes, Economics, Markov processes, Flow, Hydrologic data, Drainage area, Equations, Mathematical models, Systems analysis.
Identifiers: Lake yield, Operating schedule, Muritzseen (German Democratic Republic).

Water demands in the North German Low Lands are increasing from year to year. There is little chance of constructing reservoirs at reasonable costs. The natural lakes continue to be used; drainage is controlled through energy generation and navigational structures and the water supply is designed by experience. Flood control is frequently neglected. The largest group of lakes in the area, called the Muritzseen, are being called upon to furnish higher amounts of water for irrigation. Described is a mathematical model constructed for the reservoir considerations of these lakes. Using the Monte Carlo Method, the economic reservoir program was calculated. The calculations were done according to a simple model, which only considers the lake and describes the yield of the lake as a first-order Markov chain. It is concluded that the concept of hydrological phenomena as a process in a system enables models to be constructed, by means of which complex reservoir calculations may be performed. The undetectable influence on the effective lake yield is allowed for in the generating equation, summarized as a stochastic component. The Monte Carlo method results in a short calculating time size of reservoir are varied. (See also W77-06708) (Bell-Cornell) W77-07687

SOME PROBLEMS OF STOCHASTIC STORAGE WITH CORRELATED INFLOW,
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
Z. Kaczmarek.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971. IAHS/Unesco, Paris, France, 1974, p 453-459. 1 fig, 8 ref.

Descriptors: *Reservoir operation, *Stochastic processes, *Reservoir storage, *Evaluation, *Probability, *Simulation analysis, Inflow, Reservoir releases, Water policy, Markov processes, Equations, Mathematical models, Systems analysis.
Identifiers: Operating rules, Moran model.

This paper considers a stochastic storage model analyzed under the assumption that inflows to the reservoir are non-stationary and correlated. General principles allowing for evaluation of the probability distributions of water stored V_i and reservoir releases Q_i are presented. The proposed scheme can be applied as a simulation model for analysis of the reservoir operation under different operational policies. (See also W77-06708) (Bell-Cornell) W77-07689

SIMULATION OF IMPOUNDMENT TERRACE HYDRAULICS,
Auburn Univ., Ala. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 8B. W77-07767

IMPLEMENTATION OF NON-STRUCTURAL ALTERNATIVES IN FLOOD DAMAGE ABATEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
For primary bibliographic entry see Field 6F. W77-07795

RESIDUES OF EMULSIFIED XYLENE IN AQUATIC WEED CONTROL AND THEIR IMPACT ON RAINBOW TROUT, SALMO GAIARDNERI,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 5G. W77-07805

CHANNELIZATION: ENVIRONMENTAL, GEOMORPHIC, AND ENGINEERING ASPECTS,
North Carolina Univ. at Charlotte. Dept. of Geography and Earth Science.
For primary bibliographic entry see Field 8B. W77-07809

IMPROVEMENT AND EXPANSION OF THE DRAINAGE SYSTEM OF HAMBURG,
Abwassertechnische Vereinigung e. V., Bonn (West Germany).
For primary bibliographic entry see Field 5D. W77-07890

LAKES WILL TAKE THE POLLUTION LOAD OFF OLD FATHER TAME,
For primary bibliographic entry see Field 5G. W77-07913

DRAINAGE--WHO PAYS, RESPONSIBILITIES AFTER THE 1973 WATER ACT,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
For primary bibliographic entry see Field 5G. W77-07932

TREATING URBAN DRAINAGE AS A UTILITY,
Kramer, Chin and Mayo, Inc., Seattle, Wash.
For primary bibliographic entry see Field 5G. W77-07947

MAKING AQUATIC WEEDS USEFUL: SOME PERSPECTIVES FOR DEVELOPING COUNTRIES,
National Academy of Sciences, Washington, D.C. Commission on International Relations.
1976. 183 p. 184 ref. AID/csd-2584.

Descriptors: *Aquatic weed control, *Harvesting, *Biocontrol, *Fertilizers, Aquatic weeds, Foods, Feeds, Energy, Sewage treatment, Carp, Crayfish, Ducks (Domestic), Poultry, Swans, Dewatering, Herbivores, Forage fish, Mammals, Fish.
Identifiers: *Utilization, Paper, Grass carp, Manatees, Developing countries, Water buffalo, Silver carp, Tilapia species, Silver dollar fish.

Methods for controlling aquatic weeds and making productive use of them are examined, with particular regard to their application in less-developed countries. Techniques for converting weeds into soil additives, especially fertilizer, processed animal feeds, food, pulp, paper, fiber and energy production, as well as their use in treating sewage effluents are discussed. Biological control techniques in which herbivorous animals convert the weeds directly to meat is considered promising. The grass carp, a quick growing fish which prefers hard-to-control submerged weeds, the Tilapia species, South American silver dollar fish, and silver carp are evaluated. Manatees, a group of almost extinct tropical mammals, are shown to

be extremely proficient weed consumers, while crayfish farmed on aquatic weeds in rice fields bring premium prices as gourmet food. Ducks, geese, and swans hold promise for clearing ponds and small waterways. It is suggested that grazing of other herbivorous animals such as capybara, nutria, donkeys, pigs, sheep and water buffalo would be worth testing. Harvesting aquatic weeds, though difficult because of their environment, is considered and two promising methods of de-watering the weeds—mechanical pressing and solar drying, are described. (Luedtke-Wisconsin) W77-07964

LOCAL CONTROL OF LAND USE: PROFILE OF A PROBLEM.

Wisconsin Univ., Madison. Dept. of Rural Sociology.

For primary bibliographic entry see Field 6F.

W77-08003

FLOATING BREAKWATER.

Bridgestone Tire Co., Ltd., Tokyo (Japan). (Assignee).

For primary bibliographic entry see Field 8A.

W77-08009

MATHEMATICAL MODELING OF REGIONAL WATER-SUPPLY SYSTEMS IN YUGOSLAVIA.

Energoprojekt, Belgrade (Yugoslavia).

M. Kordic, D. Obradovic, B. Zimonja, and M. Zikic.

Journal of the American Water Works Association, Vol. 69, No. 4, p 203-205, April 1977. 2 fig. 1 ref.

Descriptors: *Regional development, *Water resources development, *Optimization, *Simulation analysis, *Computer programs, *Economic efficiency, *Mathematical models, Design, Projects, Financing, Investment, Operating costs, Pumping plants, Pipes, Water demand, Size, *Water supply, Equations, Systems analysis. Identifiers: *Yugoslavia, Pipe diameters, Staging, Locations, Benefit maximization, Economic analysis, Direct search method.

Presented is a mathematical model for solving the design problems of a regional water supply system. The multifaceted problems—calling for technical, economic, and financial analyses—are solved via a computer program and the direct search method which determines the technically feasible solution that possesses the maximum internal rate of return. The economic analysis is accomplished by discounting all investments, operating and maintenance costs, as well as income from water to present value. The optimal solution having been found together with the corresponding internal rate of return, the program automatically simulates the states of the system throughout the project's life on a yearly basis. Flows and pressures at different nodes are computed as well as power consumption; the aging of pipes is also taken into account. Then maintenance and operating costs per year are computed. Finally, the financial analysis is performed, computing the real price of water every year under given loan conditions and also the average price of water in this period. Output tables contain all data about the design adopted and the results of hydraulic, economic, and financial analyses. (Bell-Cornell) W77-08033

TOLLS: EFFICIENCY AND EQUITY ISSUES FOR INLAND WATERWAYS.

Association of American Railroads, Pittsburgh, Pa.

For primary bibliographic entry see Field 6C.

W77-08039

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS—I.

Illinois Univ. at Urbana-Champaign. Hydrosystems Lab.

V. T. Chow.

In: Mathematical Models in Hydrology. Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 3. IAHS/Unesco, Paris, France, 1974, p 1300-1314 (Session XVI). 3 fig. 2 tab, 9 ref.

Descriptors: *Water resources development, *Reservoir operation, *Simulation analysis, *Optimization, *Analytical techniques, Planning, Monte Carlo method, Economics, Hydrology, Water supply, Dynamic programming, Design, Flood control, Mathematical models, Systems analysis.

Identifiers: Open-channel hydroplants, Cost minimization.

Modern water resources systems are often very complex, being multi-purpose, multi-constraint, multi-unit, multi-state, and multi-stage. For the optimization of a tangible water resources system, two categories of modeling techniques may be distinguished: the analytical technique and the simulation technique. These two techniques are described and compared in some detail. Five papers falling within the topic of the optimal operation of water resources systems in Volume 2 of the Symposium are reviewed. Two of the papers deal with the application of the analytical technique for optimization (herein, dynamic programming) and consider the optimal seasonal and short-term operation of a reservoir used for flood control and water supply and the optimization of a three-reservoir system, respectively. The other three papers deal with the application of simulation for optimization. They consider optimal reservoir operation in the Harz Mountains, the optimal design and operation of reservoir systems, and an optimization model of a system of two open-channel hydroplants, respectively. This paper concludes with a brief discussion of the merits of discrete differential dynamic programming and of the efficiency of the Monte Carlo generating technique. Following the article are discussions by those authors whose papers were reviewed. (See also W77-06708) (Bell-Cornell) W77-08047

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS—II.

Water Research Association, Marlow (England).

J. A. Cole.

In: Mathematical Models in Hydrology. Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 3. IAHS/Unesco, Paris, France, 1974, p 1315-1333 (Session XVII). 9 fig. 2 tab, 7 ref.

Descriptors: *Water resources, *Mathematical models, *Optimization, Economic efficiency, Water utilization, River basins, Flood control, Projects, Aquifers, Deltas, Conjunctive use, Desalination plants, Streamflow, Regulation, Artificial recharge, Water storage, Hydrology, Dynamic programming, Linear programming, Equations, Operations research.

Identifiers: Control rules, Benefit maximization, Hill climbing procedure.

This article considers seven of the papers falling within the topic of the optimal operation of water resources systems in Volume 2 of the Symposium. The seven authors differ greatly in the importance they attach to presenting (1) the general philosophy of their subject, (2) the mathematical framework of modeling and optimizing a chosen type of system (expressed in algebra and flow diagrams), (3) numerical results (expressed as graphs or tables), and (4) the computational efficiency of their methods. This article emphasizes mathematical models and thus presents tabular versions of the seven papers which are set into the following framework: System (diagram); Mathematical

modeling (Input data, Objective, Methodology, and Output data); Computational details; and Examples. Discussions are included along with the tabular framework. The papers considered include: (1) a mathematical model of water resources utilization in a river basin; (2) the integration of aquifers in flood control projects; (3) construction and adjustment of a two-layer mathematical model of the Llobregat Delta; (4) conjunctive use of a multi-reservoir system and a dual-purpose desalination plant; (5) methods for control of the regimes for water resources systems; (6) optimal complex use of controlled water resources of a basin; and (7) streamflow regulation by artificial recharge fed from upstream storage. (See also W77-06708) (Bell-Cornell) W77-08048

PLANNING OF SYSTEMS FOR REGIONAL DEVELOPMENT IN WATER RESOURCES.

Technion-Israel Inst. of Tech., Haifa. Lowermilk Faculty of Agricultural Engineering.

For primary bibliographic entry see Field 6A.

W77-08049

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, TECHNICAL SESSION PRESENTATIONS, WATER RESOURCES, VOLUME I-D.

National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center.

For primary bibliographic entry see Field 7B.

W77-08062

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA.

Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).

For primary bibliographic entry see Field 7B.

W77-08064

FLOOD HAZARD STUDIES IN CENTRAL TEXAS USING ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY.

Texas Univ., Austin. Dept. of Geological Sciences.

For primary bibliographic entry see Field 7B.

W77-08069

REMOTE SENSING OF MISSISSIPPI RIVER CHARACTERISTICS.

Colorado State Univ., Fort Collins.

For primary bibliographic entry see Field 7B.

W77-08070

APPLICATION OF THERMAL SCANNING TO THE STUDY OF TRANSVERSE MIXING IN RIVERS.

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 5B.

W77-08071

UTILIZATION OF LANDSAT DATA FOR WATER QUALITY SURVEYS IN THE CHOPTANK RIVER.

General Electric Co., Beltsville, Md.

For primary bibliographic entry see Field 5A.

W77-08072

HYDROLOGIC LAND USE CLASSIFICATION OF THE PATUXENT RIVER WATERSHED USING REMOTELY SENSED DATA.

General Electric Co., Beltsville, Md.

For primary bibliographic entry see Field 7B.

W77-08073

LAND USE CLASSIFICATION FOR HYDROLOGIC MODELS USING INTERAC-

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TIVE MACHINE CLASSIFICATION OF LAND-SAT DATA,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W77-08074

REMOTE SENSING TECHNIQUES FOR PREDICTION OF WATERSHED RUNOFF,
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 7B.
W77-08075

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION,
Army Engineer District, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 7B.
W77-08076

THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE INVENTORY OF PLAYA LAKES IN THE HIGH PLAINS OF TEXAS,
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 7B.
W77-08077

REMOTE SENSING APPLICATIONS IN WATER RESOURCES MANAGEMENT BY THE CALIFORNIA DEPARTMENT OF WATER RESOURCES,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7B.
W77-08078

OPERATIONAL WATER MANAGEMENT APPLICATIONS OF SNOWCOVERED AREA OBSERVATIONS,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
For primary bibliographic entry see Field 7B.
W77-08084

4B. Groundwater Management

14C EVIDENCE FOR THE ORIGIN OF ARID REGION GROUNDWATER, NORTHEASTERN PROVINCE, KENYA,
Geological Survey, Reston, Va. Water Resources Div.
For primary bibliographic entry see Field 7B.
W77-07611

USE OF CROSS-CORRELATION TECHNIQUES FOR DETERMINING THE RELATIONSHIP BETWEEN GROUNDWATER LEVELS AND SOURCES IN THE NILE DELTA AREA,
For primary bibliographic entry see Field 2F.
W77-07679

ANALYZING NITRATES IN WELL WATER,
For primary bibliographic entry see Field 5A.
W77-07690

ENERGY DEVELOPMENT AND ITS EFFECT ON GROUND WATER,
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 5B.
W77-07691

GROUND WATER ENERGY AND THE GROUND WATER HEAT PUMP,
National Water Well Association, Worthington, Ohio.

For primary bibliographic entry see Field 8C.
W77-07694

LAW, RULES, AND REGULATIONS PERTAINING TO GROUNDWATER IN NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
June 1, 1976. 68 p. 6 ref. Compiled by G. R. Svoboda.

Descriptors: *Water law, Water rights, Legislation, *Well regulations, *Groundwater, Water pollution control, Water conservation, *Nebraska, Potable water, *Regulation.
Identifiers: *Nebraska Safe Drinking Water Act.

Nebraska laws pertaining to groundwater are presented, and the duties assigned to, or the rules and regulations developed by, various Nebraska agencies charged with the regulation of groundwater use are described. Separate chapters deal with the State Department of Water Resources, the Conservation and Survey Division of the University of Nebraska, the Nebraska Safe Drinking Water Act, portions of the 1943 Reissue Revised Statutes of Nebraska, and miscellaneous regulations. In general, surface water in Nebraska is the property of the public and subject to regulated appropriation, while water occurring beneath the land surface is regarded as pertaining to the land. The Nebraska Constitution and Revised Statutes established preferential use of water for domestic, agricultural, and industrial purposes in that order. As the Nebraska legislature has never specifically adopted any one system of groundwater rights, rules governing ground water use are derived primarily from case laws and from common-law theories. The Nebraska Groundwater Management Act of 1975 provides for regulation consistent with the California rule of correlative rights, but this new act has not been sufficiently interpreted to determine the extent to which it may have altered common-law rights. (Eberle-NWWA)
W77-07695

E.L.C. WATER DEVELOPMENT PROJECT, BETUL (M.P.) INDIA: FIFTH ANNUAL REPORT, 1975-1976,
Evangelical Lutheran Church, Betul (India). Water Development Project.
For primary bibliographic entry see Field 8B.
W77-07696

ELIMINATING IRON-BEARING WATER FROM WELL NO. 7,
Ottawa City Engineers Office, Ill.
For primary bibliographic entry see Field 5G.
W77-07702

SALTWATER-FRESHWATER INTERFACES IN THE '2,000-' AND '2,800-FOOT' SANDS IN THE CAPITAL AREA GROUND WATER CONSERVATION DISTRICT,
Louisiana Capital-Area Ground Water Conservation Commission, Baton Rouge.
C. G. Smith.
Bulletin No. 1, October 1976. 23 p. 7 fig. 10 ref. append.

Descriptors: *Saline water intrusion, *Encroachment, *Saline water-freshwater interfaces, *Groundwater barriers, Groundwater movement, Faults(Geology), Pumping, Aquifers, *Louisiana.
Identifiers: *Baton Rouge(Louisiana).

A study was undertaken by the Capital Area Groundwater Conservation Commission (Baton Rouge, I.A.) to determine origin and potential effects of saltwater found north of the Baton Rouge fault in the '2000-foot' and '2800-foot' sand aquifers. Both aquifers are heavily pumped for municipal use, and both contain saltwater at present, but the extent to which the Baton Rouge fault

prevented northward encroachment of saline water had yet to be determined. The fault created a hydrological discontinuity in the '2000-foot' sand restricting, most, but not all, saline water movement; because of salt-fresh interface in the '2800-foot' sand is already north of the fault, the effects of any existing discontinuity in this aquifer are negligible. More than 100 years were required to advance saltwater to the vicinity of public supply wells. Recommendations to ensure long-term supply of good quality water for the area included close monitoring of water level and chemical composition in certain specific wells, discouraging location of wells near the fault line in order to reduce head differential across the fault, and increased use of surface water where feasible. (Eberle-NWWA)
W77-07703

HYDROCHEMICAL OBSERVATION OF THE GROUND WATER FOR TROUT CULTURE AROUND HINO-TOWN, TOKYO, (IN JAPANESE),
For primary bibliographic entry see Field 5C.
W77-07709

SOME EXPERIMENTS ON THE GAS-DISEASE IN FRESHWATER FISHES, (IN JAPANESE),
For primary bibliographic entry see Field 5C.
W77-07714

DETERMINATION OF SALT-WATER INTER-FACE BY ELECTRIC RESISTIVITY DEPTH SOUNDINGS,
Tel Aviv Univ. (Israel). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2F.
W77-07783

WATER SAMPLING FROM UNPUMPED WELLS WITH STATIC WATER LEVELS DEEPER THAN 10 METRES,
Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 5A.
W77-07787

HIERARCHICAL MODELING FOR THE PLANNING AND MANAGEMENT OF A TOTAL REGIONAL WATER RESOURCE SYSTEM: JOINT CONSIDERATION OF THE SUPPLY AND QUALITY OF GROUND AND SURFACE WATER RESOURCES,
Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
Y. Y. Haines.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 293. Price codes: A15 in paper copy, A01 in microfiche. Ohio State University, Columbus, Water Resources Center Completion Report 494X, August 1976. 319 p. 24 fig. 35 tab. 80 ref. OWRT B-062-OHIO(1).

Descriptors: *Model studies, Planning, Management, *Regional analysis, *Ohio, *Mathematical models, *Conjunctive use, *Water quality control, *Systems analysis, *Surface-groundwater relationships, Pumping, Drawdown, Aquifers, Costs, Groundwater, Water supply, Optimum development plans.
Identifiers: *Hierarchical models, Multiobjective planning models, *Lower Great Miami River Valley(Ohio).

This research utilizes the concept and methodologies from systems engineering theory for the advanced structuring, formulating and solving of mathematical models. A planning and management methodology for a regional water quality control is presented. The planning framework is developed based on a multiobjective analysis in order to take into consideration the conflicting objectives of

surface water quality and the cost of expansion and operation of wastewater treatment plants (both secondary and tertiary). The following conclusions may be drawn: The modeling technique provides a procedure by which an accurate map of drawdown is predicted at different parts of a complex and large-scale groundwater system. The applications of the stream-aquifer response functions to the various case studies illustrate the usefulness of this study's approach in extending these important functions' applicability. They may be used either to predict infiltration from streams due to pumpage (which is an important factor for stream balance as well) or to be utilized in a management model. It is restricted to linear aquifer systems where the stream acts as a constant head boundary. Results obtained from applying the management model to the Fairfield-New Baltimore area indicate that: The model is not restricted to certain system's structure, and actually may be applied to any mathematical analysis involving groundwater linear systems' control. The effect of pumpage on drawdown is given, aggregated in cells resulting from ten-year requirement projections. The drawdowns predicted here for the Cincinnati well field exceed the figures predicted by the use of the analog model. This result should be carefully considered. The future infiltration rates from the stream provide the Miami Conservancy District with much needed information for future evaluation of stream flow balance under low flow conditions in this area. The management control mathematical model provides a comprehensive analysis of the most complicated problem of conjunctive use of ground and surface water. Case Study illustrates the model's applicability and practicability in solving problems involving groundwater system control conjunctively with other systems. The tax-quota model presented provides an improved solution strategy and also extends the capability of management models to handle groundwater recharge and surface water supply in addition to well pumpage. W77-07793

WATER QUALITY STATUS AND TRENDS IN MINNESOTA—INDICES FOR WATER SUPPLY AND GROUND WATER POLLUTION, Minnesota Univ., Minneapolis. Water Resources Research Center. For primary bibliographic entry see Field 5A. W77-07794

WASTE WATER RECLAMATION IN ST. CROIX, Black, Crow and Eidness, Gainesville, Fla. For primary bibliographic entry see Field 5D. W77-07875

GRAVITY-MEASURING DEVICE FOR WATER AND MINERAL DETECTION, For primary bibliographic entry see Field 7B. W77-08010

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, TECHNICAL SESSION PRESENTATIONS, WATER RESOURCES, VOLUME I-D, National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. For primary bibliographic entry see Field 7B. W77-08062

THE USE OF SKYLAB AND LANDSAT IN A GEOHYDROLOGICAL STUDY OF THE PALEOZOIC SECTION, WEST-CENTRAL HIGHORN MOUNTAINS, WYOMING, Wyoming Univ., Laramie. Dept. of Geology. For primary bibliographic entry see Field 7B. W77-08063

URBAN LAND USE: REMOTE SENSING OF GROUNDWATER PERMEABILITY, California Univ., Santa Barbara. Geography Remote Sensing Unit. For primary bibliographic entry see Field 7B. W77-08065

WASTE WATER RECLAMATION AT ST. CROIX, U.S. VIRGIN ISLANDS, Florida Univ., Gainesville. O. K. Buros. PhD Thesis, 1975. 362 p.

Descriptors: *Water reuse, *Groundwater recharge, *Desalination, Waste water treatment, Water resources development, Treatment facilities, Tertiary treatment, Freshwater, Groundwater, Potable water. Identifiers: St Croix (US Virgin Islands).

Groundwater recharge was compared to a desalination program to determine the better means of augmenting freshwater supplies for the island of St. Croix, U. S. Virgin Islands. Several expensive desalination plants have been constructed to produce potable water, but their expense motivated research into the use of waste water effluent for groundwater recharge. Waste water treatment plant and recharge facilities were constructed with a capacity of 0.5 mgd/day. In operation, it was possible to recharge an average of one million gallons/week. At one site, no significant adverse effects were found in groundwater extracted downstream of the project, although there was a substantial increase in groundwater. Major problems encountered were the lack of waste water for treatment and recharge, the mechanical failure of equipment, and the transfer to the main treatment plant of waste water with a high seawater content. The latter problem was the result of a 1974 flood and the problem was expected to last through 1975. The process costs are higher than those for recovery of existing groundwater, but lower than those for the desalination process. (Collins-FIRL) W77-08086

4C. Effects On Water Of Man's Non-Water Activities

FLOODFLOW FORMULAS FOR URBANIZED AND NONURBANIZED AREAS OF CONNECTICUT, Geological Survey, Hartford, Conn. Water Resources Div. L. A. Weiss.

In: Watershed Management Symposium held by the ASCE Irrigation and Drainage Division, August 11-13, 1975, Logan, Utah, p 658-675, 1975. 12 fig, 2 tab, 4 ref, 2 append.

Descriptors: *Flood control, *Urban hydrology, *Rural areas, *Flood forecasting, *Regression analysis, Streamflow, Flow rates, Historic floods, Peak discharge, Land use, Planning, *Connecticut, *Urbanization. Identifiers: *Log Pearson type III.

Data from 28 precipitation-gaging stations and 105 stream-gaging stations, which measure streamflow from drainage basins ranging in size from 1 to 1,500 sq miles are used to analyze flood magnitudes and flood frequencies in urbanized and nonurbanized areas of Connecticut. The precipitation data are used to analyze rainfall frequency for 1-, 4-, 6-, 8-, 12-, and 24-hour storm durations in the State. They also form the base for preliminary magnitude and frequency isopleth maps of the rainfall intensities used as input for a regression analysis of flood flows. Regression analyses rating the 2-year and 100-year flood-flow frequencies for nonurbanized areas to geometric parameters of the drainage basin and to rainfall magnitude and

frequency are based on data for 98 stream-gaging stations. The regression equations for nonurbanized areas are applied to urbanized areas by means of an adjustment for lag time based on the percentage of drainage area that is storm sewered. (Woodard-USGS) W77-07612

ENVIRONMENTAL GEOLOGIC ASPECTS OF PLANNING, CONSTRUCTING, AND REGULATING RECREATIONAL LAND DEVELOPMENTS, Wisconsin Dept. of Administration, Madison. State Planning Office. For primary bibliographic entry see Field 6G. W77-07630

ENERGY DEVELOPMENT AND ITS EFFECT ON GROUND WATER, National Water Well Association, Worthington, Ohio. For primary bibliographic entry see Field 5B. W77-07691

EVALUATION OF SEDIMENT YIELDS DUE TO URBAN DEVELOPMENT, Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering. For primary bibliographic entry see Field 4D. W77-07705

NUTRIENT LIMITATION IN A SMALL OLIGOTROPHIC LAKE IN NEW HAMPSHIRE, For primary bibliographic entry see Field 5C. W77-07974

4D. Watershed Protection

MANUEL TECHNIQUE DU VILLAGE, (VILLAGE TECHNOLOGY HANDBOOK), (VOLS. 1 AND 2), Volunteers in Technical Assistance, Mt. Rainier, Md. For primary bibliographic entry see Field 3F. W77-07628

AN ANALYSIS OF ALTERNATIVE FLOOD MANAGEMENT PLANS IN UPSTREAM WATERSHEDS, CONNECTICUT RIVER BASIN SUPPLEMENTAL FLOOD MANAGEMENT STUDY, PHASE 2, Soil Conservation Service, Durham, N.H. For primary bibliographic entry see Field 6F. W77-07632

THE REPRESENTATION OF A SHORT PERIOD OF EXPERIMENTAL CATCHMENT DATA BY A LINEAR STOCHASTIC DIFFERENCE EQUATION, Institute of Hydrology, Wallingford (England). For primary bibliographic entry see Field 2. W77-07646

FREQUENCY ANALYSIS OF WATER BALANCE COMPONENTS IN RELATION TO CLIMATIC FACTORS, Ebasco Services, Inc., New York. For primary bibliographic entry see Field 2A. W77-07668

FLOOD FREQUENCY STUDIES OF RIVERS IN THE FEDERAL REPUBLIC OF GERMANY, Technische Universität, Brunswick (West Germany). Leichtweiss Inst. for Water Research. For primary bibliographic entry see Field 2E. W77-07670

Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4D—Watershed Protection

STATISTICAL ANALYSIS APPLIED TO THE STUDY OF THE COMPONENTS OF A FLOOD WAVE.
Institutul de Meteorologie si Hidrologie, Bucharest (Romania).
For primary bibliographic entry see Field 2E.
W77-07674

OPTIMAL SPATIAL INTERPOLATION AND ITS ERRORS IN THE CASE OF VARIOUS DISTANCES BETWEEN OBSERVATION POINTS OR WATERSHED CENTRES.
Gosudarstvennyi Gidrologicheskii Institut, Leningrad (USSR).
G. A. Alexeev.
In: Mathematical Models in Hydrology, Volume 1: Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 305-314, 1974. 6 ref.

Descriptors: *Watersheds(Basins), *Network design, *Model studies, Mathematical models, Networks, Stations, Gaging stations, Instrumentation, Spatial distribution, Correlation analysis, Statistics, Statistical methods, Hydrology, Meteorology, Foreign research, Foreign countries.
Identifiers: *USSR, Observation points distance, Interpolation, Errors.

Objective methods (criteria) were proposed for the determination of optimal distances between observation points, proceeding from the permissible maximum mean square errors of the optimal space interpolation between every three adjacent observational points. A theoretical substantiation of the proposed criteria and formulas was given on the basis of methods of multiple correlation, proceeding from the homogeneous space correlation function of the hydrometeorological element considered. (See also W77-06708) (Sims-ISWS)
W77-07677

EVALUATION OF SEDIMENT YIELDS DUE TO URBAN DEVELOPMENT.
Old Dominion Univ., Norfolk, Va. Dept. of Civil Engineering.
C. Y. Kuo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 212. Price codes: A03 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin 98, September 1976. 28 p, 1 tab, 15 fig, 11 ref. D-009-VA.

Descriptors: Runoff, *Sediment yields, *Virginia, *Urban runoff, Storm runoff, Construction, Erosion control, Hydrographs, Measurement, Erosion rates, Equations, *Soil erosion, Evaluation.
Identifiers: Runoff hydrographs, *Dilution factor(Sediments), *Universal Soil Loss Equation.

This research project sought to determine sediment yields in the Cedar Hill area, Virginia Beach, Virginia. Using a modified Universal Soil Loss Equation, soil-erosion rates were estimated at construction, semi-construction, and well-developed sites in this area. Sediment yields then were measured at the three sites and at a downstream monitoring station and compared with the estimates. Dilution factors also were studied as a function of rainfall intensities, and are believed to correlate with the characteristics of the area undergoing construction. The dilution factor was defined as the ratio of suspended-sediment concentration on the site compared to that for an off-site specific downstream station at the peak hours of runoff hydrographs. The dilution factor was found to increase as rainfall intensity decreased, and on-site soil erosion rates varied according to the stage of construction.
W77-07705

GULLY WALL STABILITY IN LOESS-DERIVED ALLUVIUM.
Agricultural Research Service, Columbia, Mo.

J. M. Bradford, and R. F. Piest.
Soil Science Society of America Journal, Vol. 41, No. 1, p 115-122, January-February 1977. 7 fig, 3 tab, 13 ref.

Descriptors: Soil mechanics, *Soil strength, *Gully erosion, Loess, Erosion, Tensiometers, Piezometers, Slope stability, Groundwater, Sedimentation, On-site investigations, Water pollution.
Identifiers: *Soil morphology, *Gully wall stability, Loess-derived alluvium, Triggering mechanisms, Gully slumping, Gully walls, Gully slopes.

A field study was made on an instrumented vertical slope to investigate the triggering mechanisms that initiate gully wall failure in loess-derived alluvium. The relevance of hydrology, soil morphology, and soil mechanics to an understanding of gully slumping was examined. Conventional limit equilibrium slope stability methods were of little value in predicting failure volumes or in understanding the failure mechanics. The geometry and time of failure were greatly influenced by the structural features of loess-derived alluvium and by the dependence of the shear strength on the pore water pressure within the soil. (Roberts-ISWS)
W77-07764

EVALUATION OF POTENTIAL USE OF VEGETATION FOR EROSION ABATEMENT ALONG THE GREAT LAKES SHORELINE.
Dames and Moore, Cincinnati, Ohio.
V. L. Hall, and J. D. Ludwig.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A014 137. Price codes: A03 in paper copy, A01 in microfiche. Army Corps of Engineers, Coastal Engineering Research Center, Ft. Belvoir, Va., Miscellaneous Paper No 7-75, June 1975. 35 p, 11 fig, 5 tab, 22 ref.

Descriptors: *Great Lakes, *Vegetation effects, *Shoreline cover, Coastal structures, Dewatering, Erosion control, Erosion, Vegetation, Shores, Beach erosion, Waves(Water).
Identifiers: Shoreline changes, Hydrophytes, Resloping.

This study identified plants with potential, either alone or in combination with structures, to alter the erosion rate along shores of the Great Lakes. Information was obtained from literature, personal interviews, and field survey. Shoreline plants were identified and evaluated. Thirty-three terrestrial species were found that effectively decrease surface erosion resulting from wind and runoff. No emergent or submergent plants were found to control erosion. While several emergent species may have special use in low-energy areas, the Great Lakes shores in the United States are generally not conducive to establishment of aquatic plants. Shores subject to wave erosion require structures or beach nourishment to attenuate wave energy. After the wave force is reduced by engineering techniques, vegetation will aid in controlling surface erosion. Subsurface seepage and soil slumping, which cause landslides and bank recession, can be prevented by dewatering glacial till; recession of sandy shores with steep banks can be controlled by bank resloping. The study concluded that plants alone are not suitable for use as erosion controllers along most shores of the Great Lakes because of severe wave action. (Lee-ISWS)
W77-07788

PENN STATE URBAN RUNOFF MODEL--USER'S MANUAL.
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
G. Aron, and D. F. Lakatos.
Available from the National Technical Information Service, Springfield VA 22161 as PB-267 312. Price codes: A04 in paper copy, A01 in microfiche.

Research Publication 96, December 1976. 69 p, 4 tab, 5 fig, 8 ref, 4 app end. Institute for Research on Land and Water Resources, University Park, PA. OWRT B-076-PA(1). 14-0001-5108.

Descriptors: *Planning, *Computer models, *Storm runoff, *Storm water, Surface runoff, *Urbanization, Floods, *Urban drainage, Urban hydrology, Urban runoff, Management, Model studies, Water quality, Simulation analysis.
Identifiers: *Urban runoff model, Total watershed response, *Runoff quality, Subarea flow, Hydrologic budget models, *Penn State Urban Runoff Model.

Successful urban water resources management depends on the ability of urban planners and managers to predict accurately, in advance, the effects that increased urban development will have on stormwater runoff. The present inability to predict watershed response is a major factor leading to increased urban flooding, and a lowering of runoff quality due to the lack of proper control. The situations for which the use of the Penn State Urban Runoff Model is intended are less general than those of many current urban runoff models. The Penn State Runoff Model was developed as an alternative to the traditional Rational Method and other semi-empirical procedures for urban drainage design. It deals entirely with the quantity of stormwater runoff, and does not directly consider urban runoff quality. The objectives adopted for the development of the Penn State Urban Model Were: (1) to produce an urban runoff simulation model which would provide acceptable hydraulic accuracy while remaining at a level of sophistication compatible with minimum practice and data collection time, (2) to keep the model as simple and concise as possible to insure its convenient use, (3) to allow for the analysis of the timing of subarea flow contributions to peak rates at various points in a watershed. (Sink-Penn State).
W77-07797

MODELING NONPOINT POLLUTION FROM THE LAND SURFACE.
Hydrocomp Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5B.
W77-07818

WATERSHED MANAGEMENT AND WATER QUALITY.
Environmental Protection Agency, Boston, Mass. Water Supply Branch.
For primary bibliographic entry see Field 5G.
W77-07951

FLOOD HAZARD STUDIES IN CENTRAL TEXAS USING ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY.
Texas Univ., Austin. Dept. of Geological Sciences.
For primary bibliographic entry see Field 7B.
W77-08069

HYDROLOGIC LAND USE CLASSIFICATION OF THE PATUXENT RIVER WATERSHED USING REMOTELY SENSED DATA.
General Electric Co., Beltsville, Md.
For primary bibliographic entry see Field 7B.
W77-08073

REMOTE SENSING TECHNIQUES FOR PREDICTION OF WATERSHED RUNOFF.
Texas A and M Univ., College Station.
For primary bibliographic entry see Field 7B.
W77-08075

WATERSHED ORGANIZATIONS--IMPACT ON WATER QUALITY MANAGEMENT: AN ANALYSIS OF SELECTED MICHIGAN WATERSHED COUNCILS.
Michigan State Univ., East Lansing.

E. J. Hood.
PhD Thesis, 1976. 89 p.

Descriptors: *Watershed management, *Evaluation, *Watersheds(Basins), Rural areas, Urban areas, Legislation, Environmental control, Water quality control, Planning, Water management(Applied).
Identifiers: Michigan.

A case study approach was used to examine the effectiveness of Michigan watershed councils in watershed management and water quality control. The study was designed to reveal problems and make recommendations for more effective activities. It was revealed that effective water quality management planning was limited to advisory, planning and information-educational functions. Effectiveness of the councils depended on variations in enabling legislation; character of the watershed (urban or rural); level and type of participating membership; continuity in leadership; executive committee direction and perception; ability to seek financial and other aids from other groups; level of communication with constituents, state government, and other councils; and on whether the approach taken was a service or an issue approach. The weaknesses found were primarily due to statutory deficiencies, and to structural and operational difficulties of internal organization, orientation, and approach. These were not uniform but varied among the councils in type and degree. Recommendations were suggested to alleviate the problems associated with the above factors. (Collins-FIRL)
W77-08093

5. WATER QUALITY MANAGEMENT AND PROTECTION

ON THE RELATION OF THE DIATOM FLORA AND WATER QUALITY IN THE UJI RIVER KYOTO, (IN JAPANESE),
Osaka Seikei Women's Jr. Coll. (Japan). Biology Lab.
T. Zoriki.
Jpn J Limnol 37(1), p 29-36, 1976.

Descriptors: Sampling, *Diatoms, Water quality, *Benthos, *Oligotrophy, *Mesotrophy, Rivers, Asia, Water pollution.
Identifiers: Cymbella-tumida, Cymbella-turgidula, Cymbella-ventricosa, Fragilaria-crotonensis, Gomphonema-olivaceum, *Japan(Kyoto), Melosira-granulata, Melosira-granulata-var-angustissima, Melosira-italica, Melosira-solida, Navicula-cincta, Navicula-cryptoccephala, Navicula-cryptoccephala-var-exilis, Nitzschia-acicularis, Nitzschia-amphibia, Nitzschia-clausi, Nitzschia-frustulum, Synedra-acus, Synedra-radians, Synedra-rumpens-var-familiaris, Synedra-ulna, *Uji River(Japan).

Thirteen samples were collected at 4 stations in the Uji River, Kyoto (Japan), from May 1970-Nov. 1973. The species identified belong to 33 genera and 165 spp. in total as benthic diatoms. The relative frequencies of those diatoms which are 5% total 20. Those 20 diatoms can be classified according to the 3 grades of the 3 grades of water quality as follows: oligosaprobic Cymbella tumida, Fragilaria crotonensis, Melosira granulata, M. granulata var. angustissima, M. italica, M. solida and Nitzschia clausi; both alpha-oligo and beta-mesosaprobic, C. turgidula, Navicula cincta, N. cryptoccephala and N. cryptoccephala var. exilis; alpha-oligo, beta- and alpha-mesosaprobic, C. ventricosa, Gomphonema olivaceum, Nitzschia acicularis and Synedra ulna; beta-mesosaprobic, N. amphibia, N. frustulum and S. radians; both beta- and alpha-mesosaprobic, S. rumpens var. familiaris; alpha-mesosaprobic, S. acus.—Copyright 1977, Biological Abstracts, Inc.
W77-08089

5A. Identification Of Pollutants

MERCURY IN WATER, A BIBLIOGRAPHY, VOLUME 3,
Office of Water Research and Technology.
Washington, D.C.
Water Resources Scientific Information Center,
Report OWRT/WSIC 77-202, April 1977, 169 p.

Descriptors: *Mercury, *Bibliographies, *Pollutant identification, *Heavy metals, *Methylmercury, Path of pollutants, Toxicity, Waste water treatment, Analytical techniques.

This report, containing 214 abstracts, is another in a series of planned bibliographies in water resources produced from the information base compromising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the information base had 104,878 abstracts covering SWRA through February 1977(Volume 10, Number 4). Author and subject indexes are included.(See also W72-04440 and W75-8934.)
W77-07605

MUTAGENIC POTENTIAL OF PETROLEUM BYPRODUCTS IN CHESAPEAKE BAY WATERS,
Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W77-07606

HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME 4, (ANALYTICAL METHODS FOR SEWAGE SLUDGE ANALYSIS),
Toronto Univ. (Ontario). Inst. of Environmental Sciences.
J. C. Van Loon.
Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 51, Environmental Protection Service, Environment Canada, Ottawa, Canada, 1976, 33 p., 5 fig., 6 tab, 7 ref. 72-5-3.

Descriptors: *Heavy metals, *Agricultural chemicals, *Sewage sludge, Methodology, Analysis, Chromatography, Cadmium, Lead, Mercury, Zinc, Pollutant identification.
Identifiers: *Atomic adsorption studies, Mercury method, Hydride technique, Tin, Silver, Vanadium.

Existing and newly developed analytical methods for sewage sludge analysis are reviewed. It had been stressed earlier that knowledge of the form of metals in waste and environmental samples is of great importance. As a result of this the development of simple equipment and analytical method to initiate metal speciation has been stressed. Procedures developed earlier and used provisionally have been studied in depth. The mercury method is now acceptable as recorded. The As/Se procedure has been modified as a result of further investigation. Nonflame atomic absorption methods have been developed for silver and vanadium. It is demonstrated that using atomic absorption spectroscopy as a detector does not guarantee a quick solution to metal speciation problems. Sludges can be dry-shed at 450 C without fear of loss of cadmium, lead or appreciable amounts of zinc. When aluminum is to be determined, dry-ashing should not be used. Data also make it clear that incineration at temperatures usually employed will release large amounts of arsenic, cadmium, lead, mercury and zinc. A number of sewage sludges were analyzed, and the results are tabulated. (See also W76-07676; W76-04244 and W74-08397) (WATDOC)
W77-07614

INTERLABORATORY QUALITY CONTROL STUDIES NOS. 12 AND 13, ALUMINUM, CADMIUM, CHROMIUM, COBALT, COPPER, LEAD, IRON, MANGANESE, NICKEL AND ZINC,
Canada Centre for Inland Waters, Burlington (Ontario).
J. M. Carron, and K. I. Aspila.
Report Series No. 44, 1976, Ottawa, Canada, 20 p., 11 tab, 1 ref., 3 append.

Descriptors: *Water sampling, *Quality control, Cadmium, Chromium, Cobalt, Copper, Lead, Iron, Manganese, Aluminum, Nickel, Zinc, Analysis, Metals, *Pollutant identification.
Identifiers: Natural water, Fortified natural water, Synthetic water, Atomic absorption spectrophotometry.

The studies involve the analysis of aluminum, cadmium, chromium, cobalt, copper, lead, iron, manganese, nickel and zinc in natural and synthetic water samples. All metals were at concentrations similar to those found in natural waters (1-50 mg metal/l). Twelve water samples were analyzed for this combined report, including natural, fortified natural and synthetic samples. Combination of such samples provided percent recovery of trace metals from (1) synthetic standards, (2) samples fortified by participants and (3) samples fortified, but unknown, to participants. Twenty-six laboratories provided data for this combined study. Five different methodologies were used, and results for each have been summarized and in some cases discussed. Mean values, standard deviations and percent recoveries are provided for all samples and for each method. Much of the data provided by participants were indicated as less than a designated value. Treatment of such data for computational purposes is discussed. Overall, the data provided by participants normally analyzing natural lake and river waters at low level metal concentrations (0.1-50 mg/l) were quite acceptable. (WATDOC)
W77-07616

DETERMINATION OF MORESTAN IN WATER, SOIL, AND CUCUMBERS BY THIN-LAYER CHROMATOGRAPHY, (IN RUSSIAN),
Vserossiiskii Nauchno-Issledovatel'skii Institut Zashchity Rastenii, Ramon (USSR). Lab. of Toxicology.
V. S. Shustrov, and A. A. Krasnykh.
Vopr Pitani 3, p 79, 1976.

Descriptors: *Pollutant identification, *Cucumbers, *Pesticide residues, *Chromatography, Soil analysis, Water analysis.
Identifiers: *Morestan, Thin layer chromatography.

The method for determining microquantities of Morestan in water, soil and cucumbers is based on the extraction of the pesticide from the sample using chloroform or carbon tetrachloride, distillation of the solvent and silica gel TLC. The sensitivity of the method is 5 micro-g in a sample. In tests to verify the accuracy of the method, 10, 20, 40 and 50 micro-g of Morestan were added to water, soil and cucumber pulp. The percentage of residue determined was 85-100 of the quantity added.—Copyright 1977, Biological Abstracts, Inc.
W77-07688

ANALYZING NITRATES IN WELL WATER,
W. W. Whitlock, Jr.
Water and Sewage Works, Vol. 124, No. 3, p 63, March, 1977, 1 fig.

Descriptors: *Nitrates, *Water analysis, *Sampling, Water pollution sources, Water pollution effects, Farm wastes, *Pollutant identification, Water wells, *Maryland.
Identifiers: *Harford County(Maryland), Wisahickon Schist Formation.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

A routine free water sampling program in Harford County, Maryland, has uncovered scattered case of severe nitrate contamination of ground water, due to the manure concentrations in barnyards and feedlots in some parts of the county. Nitrates have a hazardous effect specifically for infants between 6 and 18 months old (methemoglobinemia) which reduces the oxygen transport capability of the blood and can result in brain damage or death. Whenever nitrate levels greater than 10 ppm are observed in samples, local procedure requires notification of the resident, sampling of adjacent wells if possible, periodic follow-up at varying intervals, and sampling of water beneath undeveloped lots before issuing building permits. Extensive, frequent surveys will be necessary to verify contamination fluctuation trends and to determine possible relationships to weather, soil content, ground water movement, etc. (Eberle-NWNA) W77-07690

Snake River, 1973 Dissolved Gas Studies.

Parametrix, Inc., Seattle, Wash.
Submitted to Idaho Power Company, Boise, Idaho. Final Report, August 1974, 58 p, 7 tab., 17 fig., 10 ref., 2 append.

Descriptors: *Nitrogen, Gases, On-site investigations, *Dam sites, Saturation, *Supersaturation, *Water temperature, *Reservoirs, *Seasonal discharge (Water), Freshwater fish, Bass, Invertebrates, *Monitoring, *Idaho, *Oregon, Pollutant identification.

Identifiers: *Dissolved gas monitoring, *Snake River, *Nitrogen partial pressures, Brownlee Reservoir, Water temperature increase, *Oxbow Dam, *Hell's Canyon Dam, Oxbow Powerhouse, Vacuum Breakers, *Salmon River, Innaba River.

The dissolved gas monitoring of the upper region of the Snake River showed nitrogen partial pressures remained near or below saturation during 1973. In this area a maximum of 106% was measured below Twin Falls. Nitrogen partial pressures (saturation) remained near saturation from March through May in Brownlee Reservoir, but rose to as high as 110% of saturation in July, August, and September. The rise in the nitrogen partial pressure was due to an increase in water temperature that more than compensated for a decrease in actual nitrogen concentrations. In both Oxbow and Hell's Canyon Reservoirs the nitrogen partial pressure and nitrogen concentration decreased slightly in the upstream shallow portions of the reservoirs. The nitrogen levels remained constant in the downstream portions of the reservoirs. Nitrogen partial pressures at the Oxbow Bridge location were up to 120% saturation in August and September. Downstream from Hell's Canyon Dam the nitrogen partial pressures, in general, remained below 110% of saturation, although they were somewhat higher immediately below the dam in June and July. In September the partial pressures were above 110% in most of the river below the dam. The Salmon River was as high as 116% of saturation in July, and the Innaba River up to 112% in September. (Katz) W77-07710

DISSOLVED GAS DATA REPORT, 1975-1976,
Army Engineer District, Portland, Oreg. North Pacific Div.
January, 1977. 64 p, 26 fig., 5 ref., 64 p, 2 append.

Descriptors: *Columbia River, Saturation, *Supersaturation, *Oxygen, *Nitrogen, Argon, On-Site investigation, On-Site data collections, Monitoring, Evaluation, Water temperature, Depth, *Dam, Dam sites, *Bonneville Dam, *Spillways.
Identifiers: *Snake River, *Columbia River Basin, *Percent saturation, *Spillway deflector.

The data regarding the dissolved gas content on the Snake and Lower Columbia Rivers for 1975 and 1976 are reported. The effectiveness of the spillway deflectors is discussed. The deflectors at McNary, Little Goose, Lower Monumental and Lower Granite Dams have helped reduce the dissolved gases below these projects to a tolerable level. The deflector at Bonneville Dam did not reduce the gas levels as expected. (Katz) W77-07718

DISSOLVED GAS SUPERSATURATION IN THE SALMON RIVER, 1972-74.

Parametrix, Inc., Bellevue, Wash. Environmental Services Section.

Prepared for Idaho Power Company, Boise, Idaho September, 1974, 27 p., 12 fig, append.

Descriptors: *Idaho, *Supersaturation, *Saturation, *Gases, *Oxygen, *Nitrogen, Water quality, *Water temperature, On-Site investigation, Flow rates, High flow, Low flow, Sampling, Seasonal, *Monitoring, Pollutant identification.
Identifiers: *Dissolved gas, *Nitrogen, Partial pressure, *Salmon river, Dissolved nitrogen, High flow period, Low flow period, *Snake River.

Dissolved gas levels in the Salmon River, Idaho, were monitored during selected periods between September, 1972 and June, 1974. This monitoring took place during a wide variety of flow and temperature conditions. Nitrogen partial pressures were found to exceed saturation in the lower portion of the Salmon River during both high and low flow periods. Nitrogen supersaturation as high as 121% was measured in the downstream portion of the river. Supersaturation was the result of both increases in the amount of dissolved gas and increases in water temperatures as the water moved downstream. Increases in the amount of dissolved nitrogen were of most importance during high flow periods, whereas temperature increases were primarily responsible for supersaturation during low flow periods. (Katz) W77-07719

GAS-BUBBLE DISEASE: A REVIEW IN RELATION TO MODERN ENERGY PRODUCTION,

Rhode Island Univ., Kingston. Marine Pathology Lab.

For primary bibliographic entry see Field 5C.

W77-07721

VERTICAL MIXING MECHANISMS AND THEIR EFFECTS ON PRIMARY PRODUCTION OF PHYTOPLANKTON,

Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.

For primary bibliographic entry see Field 5C.

W77-07733

RESULTS OF R/V YAQUINA CRUISE YALOC-74, LEG 3: SEABED DISPOSAL PROGRAM, NORTH PACIFIC STUDY AREA MPG-2, 33 DEGREES 20'N, 151 DEGREES 00'W, NOV. 30 - DEC. 21, 1974.

Rhode Island Univ., Kingston. Graduate School of Oceanography.

For primary bibliographic entry see Field 5E.

W77-07739

MONITORING DISSOLVED HYDROCARBONS AS A FUNCTION OF THE TIDAL CYCLE (NEW YORK HARBOR).

Coast Guard Research and Development Center, Groton, Conn.

For primary bibliographic entry see Field 5B.

W77-07740

EFFECTS OF SAMPLE HANDLING ON THE COMPOSITION OF MARINE SEDIMENTARY PORE WATER,

Lehigh Univ., Bethlehem, Pa. Center for Marine and Environmental Studies.

M. H. Hulbert, and M. P. Brindle.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A016 730. Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: Geological Society of America Bulletin, Vol 86, No 1, p 109-110, January 1975. 1 tab, 12 ref. NSF-GA-37079; ONR-N00014-67-A-0370-005.

Descriptors: *Gulf of Mexico, *Sediments, *Pore water, Laboratory tests, *Pollutant identification, Sampling.

Identifiers: *Interstitial water, Storage conditions.

Three sediment samples from the Gulf of Mexico abyssal plain were subjected to five representative handling and storage procedures before the pore water was expressed and analyzed for Na⁺, K⁺, Mg²⁺, and Ca²⁺. The observed alterations in major cation concentrations during storage did not appear to be entirely related to temperature. Samples stored at in situ temperatures unexpectedly displayed greater changes than those which were stored at room temperature and subsequently resealed. (Sinha-OEIS)

W77-07742

UTILIZATION OF MIXED HYDROCARBON SUBSTRATE BY PETROLEUM-DEGRADING MICROORGANISMS,

Maryland Univ., College Park. Dept. of Microbiology.

For primary bibliographic entry see Field 5C.

W77-07749

PETROLEUM OIL DETECTION BUOY SYSTEM,

Spectrogram Corp., North Haven, Conn.

H. R. Gram.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A016 461. Price codes: A03 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Final Report No. CG-D-39-75, March 31, 1975. 30 p, 5 fig, 1 tab, 1 ref, 1 photo.

Descriptors: *Oil pollution, Water pollution control, *Buoys, Fluorescence, *Pollutant identification.

Identifiers: *Oil detection.

Extended capability floating buoy designed to detect petroleum oils ranging in composition from crude to kerosene has been developed and performance tested. This buoy is powered by a land based low voltage direct current power supply at nominally 12 volts. The average total power requirements for the buoy are less than 0.75 watts. The detection system employs fluorescent techniques whereby the oils floating on the water surface are excited by short wavelength ultraviolet radiation and produce, by fluorescence emission, radiation in the near ultraviolet and blue end of the visible spectrum. The fluorescent radiation is selectively detected to produce an alarm condition. Improvements have been made to the mechanical packaging to facilitate deployment and field service. (Sinha-OEIS) W77-07750

A METHOD FOR DETERMINING OIL IN WATER,

Naval Research Lab., Washington, D.C.

A. Stamulis.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A007 871. Price codes: A02 in paper copy, A01 in microfiche. Memorandum Report 2741, March 1974. 18 p, 1 fig, 3 tab, 10 ref.

WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

Identification Of Pollutants—Group 5A

Descriptors: *Oil pollution, *Water pollution sources, Organic compounds, Chromatography, Dye dispersion, Monitoring, *Pollutant identification, *Oil wastes, Analytical techniques.

A preliminary study has been made on a dye technique for determining the concentration of small amounts of oil in water. The mixing action of a blender results in the formation of a large number of oil droplets in water from one original oil drop. The subsequent addition of a suitable amount of oil-soluble dye to the system with additional blending action results in a homogeneous colored solution. Hence, low concentrations of oil in water can be visually determined. Under laboratory conditions, using tap water as the continuous phase, test 'oils' such as crudes, esters, paraffins and silicones gave positive results. However, protective colloid action in some cases masked the color test. The converse of the principle, i.e., the determination of water-in-oil, is also possible using a water soluble dye. At the present time the method is subjective and qualitative in nature. In the future it is contemplated that the method can be made quantitative with an arbitrary standard oil (No. 6 or Bunker C) and with the proper instrument of choice. (Sinha-OEIS)
W77-07756

ESTABLISHING SOIL ELECTRICAL CONDUCTIVITY-SALINITY CALIBRATIONS USING FOUR-ELECTRODE CELLS CONTAINING UNDISTURBED SOIL CORES, Agricultural Research Service, Riverside, Calif. Salinity Lab.
For primary bibliographic entry see Field 2G.
W77-07776

WATER SAMPLING FROM UNPUMPED WELLS WITH STATIC WATER LEVELS DEEPER THAN 10 METRES, Ministry of Works and Development, Christchurch (New Zealand). Water and Soil Div. G. N. Martin.
Journal of Hydrology (New Zealand), Vol 15, No 1, p 41-45, 1976, 1 fig, 1 ref.

Descriptors: *Sampling, *Equipment, *Water wells, Pumps, Pumping, Wells, Test wells, Groundwater, Subsurface waters, Water quality, Water sampling, Instrumentation, On-site investigations, Water pollution, Pollutant identification.
Identifiers: *Sampling pumps, Groundwater sampling.

One of the problems encountered in groundwater quality surveys is that of obtaining samples from wells not equipped with pumps and where the static water level is at a depth greater than that which permits sampling by simple suction techniques. This problem is particularly acute when special sampling and observation bores are drilled for investigation purposes alone. In a recent investigation of groundwater quality in the aquifers of New Zealand's Canterbury Plains, this sampling problem was encountered. Owing to the nature of the investigations, the following requirements had to be met by the sampling apparatus: (1) maximum diameter less than 65 mm, (2) hand or battery operated, (3) portable, (4) fully autoclavable (for sampling for bacteriological purposes), (5) free of metal (for sampling for trace amounts of metals), (6) capable of operating to depths of at least 30 m, and (7) simple to operate and of low cost. These criteria were met satisfactorily by the final pump design. (Sims-ISWS)
W77-07787

DEVELOPMENT OF THE TURBIDITY MAXIMUM IN RAPPAHANNOCK ESTUARY; SUMMARY, Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 2L.
W77-07789

WATER QUALITY STATUS AND TRENDS IN MINNESOTA—INDICES FOR WATER SUPPLY AND GROUND WATER POLLUTION, Minnesota Univ., Minneapolis. Water Resources Research Center.

C. P. Straub, V. M. Goppers, and A. DuChene. Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 331. Price codes: A10 in paper copy, A01 in microfiche. Completion Report, October 1976, 192 p, 32 fig, 25 tab, 12 ref, 3 append. OWRT A-029-MINN(2).

Descriptors: *Water quality standards, *Minnesota, *Water supply, *Water pollution sources, *Groundwater, *Public health, *Potable water, Data collections, Aquifers, Computer programs, *Water analysis, *Chemical analysis, Calcium carbonate, Alkalinity, Calcium, Hydrogen ion concentration, Chlorides, Sulfates, Iron, Manganese, Fluorides, Nitrogen, Sodium, Potassium, *Pollutant identification.

The status of water quality in Minnesota was examined in relation to the chemical data available on public water supplies based upon sample analyses by the Minnesota Department of Health, reported in 1971 and upgraded in 1972. Information presented included an up-to-date summary of facts covering ownership, pumpage, source, installation, treatment, storage, chemical quality for public water supplies in the State of Minnesota. The chemical analysis data included: date of sample, total hardness (as CaCO₃), alkalinity (as CaCO₃), calcium (as CaCO₃), pH, pH of stability, iron (as Fe), manganese (as Mn), chlorides (as Cl), sulfate (as SO₄), fluorides (as F), nitrate nitrogen (as N), sodium (as Na), potassium (as K), and total solids. It was necessary to develop a system for comparing existing quality with some accepted standards or criteria. Comparisons permitted an indication of the number of supplies and the populations they served that met various selected concentrations. Quality comparisons are indicated for hardness (as CaCO₃), iron, manganese, chlorides, sulfates, nitrates, sodium, and filterable residue (total solids). Attempts were made to use some of the analytical data to identify specific aquifers supplying water and these results are reported, as are data obtained in the application of a simplified additive approach for calculating a water quality index for each supply. A computer program was developed for subsequent retrieval of the chemical analysis data available and the physical and other data characterizing each public water supply including treatment. Techniques developed for characterizing specific organic contaminants in water are described.
W77-07794

EXTRACTION AND SEPARATION OF POLYCHLORINATED BIPHENYLS FROM PESTICIDE MONITORING SAMPLES, Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md. J. M. Heller.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A011 242. Price codes: A02 in paper copy, A01 in microfiche. Entomological Special Study No. 44-042-74/75, 15 April 1975, 9 p, 2 append.

Descriptors: *Polychlorinated biphenyls, Pollutant identification, Laboratory tests, Methodology, *Analytical techniques, *Pesticides, *Insecticides, *Chlorinated hydrocarbon pesticides, *Monitoring, Entomology, *Aroclors, Chemical analysis, Chemical wastes, Sampling.
Identifiers: *Percent insecticide recovery.

A new method was tested for the removal of polychlorinated biphenyls (PCB's) from biological samples. These industrial chemicals are ubiquitous in biological samples such as fish and bird adipose tissue. Based on retention characteristics they can be easily misidentified as organochlorine pesticides. The PCB's are partially or completely recovered from a Florisil(Trade Name) column

using the multiresidue methodology for organochlorine pesticides. A silic acid column was spiked with a solution of 4 PCB's and 11 insecticides. Performance of the method was judged by percent recovery of pesticides along with their complete separation from the PCB's and p,p'-DDE. The method performed well with respect to the above mentioned criteria and has been incorporated into the Department of the Army Pesticide Monitoring Program for the routine separation of PCB's from pesticides in biological samples. (Katz)
W77-07826

EVALUATION OF ERYTHROCYTE DELTA AMINO LEVULINIC ACID DEHYDRATASE AS A SHORT-TERM INDICATOR IN FISH OF A HARMFUL EXPOSURE TO LEAD, Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W77-07837

EFFECTS OF THERMAL SHOCKS ON DRIFTING AQUATIC INSECTS: A LABORATORY SIMULATION, Virginia Polytechnic Inst. and State Univ., Blacksburg, Va. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-07839

PROTECTIVE EFFECT OF CHLORIDE ON NITRITE TOXICITY TO COHO SALMON (ONCORHYNCHUS KISUTCH), Rhode Island Univ., Kingston. Dept. of Animal Science.
For primary bibliographic entry see Field 5C.
W77-07840

EFFECTS OF INORGANIC COMPLEXING ON THE TOXICITY OF COPPER TO DAPHNIA MAGNA, Environmental Research Lab., Duluth, Minn.
For primary bibliographic entry see Field 5C.
W77-07842

EGG HATCHABILITY AND TOLERANCE OF BROOK TROUT (SALVELINUS FONTINALIS) FRY AT LOW PH, Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
For primary bibliographic entry see Field 5C.
W77-07844

A STUDY ON THE STRENGTH OF SEWAGE, For primary bibliographic entry see Field 5B.
W77-07853

GAS DETECTORS DETERMINE HEALTH HAZARDS IN SEWAGE TREATMENT. Water and Sewage Works, Vol 124, No 3, p 60, March, 1977.

Descriptors: *Monitoring, *Hydrogen sulfide, *Gases, *Hazards, *Sewers, Pumping plants, Maintenance, Personnel, Safety, Toxicity, Sewage treatment, Pollutant identification.
Identifiers: Los Angeles City Sewer Maintenance Department(CA).

The Los Angeles City Sewer Maintenance Department has acquired portable combination H₂S and combustible gas detectors. These gases have become known safety problems in sewage and water treatment. The detectors consist of a sensor, alarms, a charger, a three and one-half inch meter, and an optional miniature sample pump. The units weigh five and one-half pounds. The instruments are very durable and easily calibrated. Detectors are preset for audible alarm at 30-35 ppm H₂S and 20% LEL for combustible gases. They are placed

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification Of Pollutants

at three points at any entry to a pumping station. The sensor is directed to the above-ground wet well vent to monitor gas concentration in the concrete-enclosed rooms below, and operates at slightly above ambient temperature. The instrument is worn for all work in the underground pump room. The detector is placed on a metal grid walkway above the waste water flow in the wet well when the area is cleaned. H₂S is the one highly toxic gas which cannot be detected by smell at low concentrations of 100-150 ppm. Concentrations at 700 ppm can cause instant unconsciousness and death. The other gas combinations in the area of sewer maintenance are all explosive. The Los Angeles maintenance group requires that workmen immediately leave the area at first warning. (Collins-FIRL)
W77-07880

AUTOMATIC ANALYSIS CONTRIBUTES TO WASTE WATER TREATMENT EFFICIENCY,
Instrumentation Technology, Vol. 24, No. 2, p 10, February, 1977.

Descriptors: *Instrumentation, *Measurement, *Treatment facilities, Aeration, Nitrification, Denitrification, Nitrogen, Biochemical oxygen demand, Suspended solids, Groundwater recharge, Water wells, *Waste water treatment, Chlorination, Disinfection.
Identifiers: Suffolk County(NY).

Suffolk County, New York, is meeting municipal standards and more efficiently operating a waste water treatment plant with automatic measurement of mixed liquor suspended solids (MLSS). Complete treatment is provided before groundwater recharge. Groundwater wells provide all drinking water for the area. A nitrogen level of less than 10 milligrams/liter was required by the county environmental control agency. The plant operates in two stages: extended aeration/nitrification and suspended growth denitrification. The design capacity allows for 288,000 gpd, but the present operation rate is 50,000 gpd. The analyzer chosen consists of a sensing probe on the downflow side in the center of the aeration tank and a remote digital readout, in ppm, in the control building. Readouts are checked against MLSS gravimetric tests in the plant laboratory. Treatment goals included 85% BOD removal, 90% suspended solids removal, and continuous chlorination for disinfection. (Collins-FIRL)
W77-07909

THE ACTIVATED SLUDGE PROCESS WITHOUT PRELIMINARY PURIFICATION. RESULTS OF PILOT EXPERIMENTS IN THE PURIFICATION PLANT KARLSRUHE (DAS BELEBUNGSVERFAHREN OHNE VORREINIGUNG. ERGEBNISSE DER VERSUCHE IM HALBTECHNISCHEN MASSSTAB IM KLAERWERK KARLSRUHE),
For primary bibliographic entry see Field 5D.
W77-07927

EASIER IDENTIFICATION WITH MPN PROCEDURE.
Nampa Waste Water Treatment Plant, Idaho.
A. Dorfest, C. Howard, and V. Williams.
Deeds and Data, p 4, November, 1976. 2 tab, 2 ref.

Descriptors: *Analytical techniques, *Water quality control, *Bioindicators, Analysis, Coliforms, E. coli, Bacteria, Color, Laboratory tests, Waste water treatment, Chemical reactions, *Pollutant identification.
Identifiers: Brom cresol purple, Lauryl tryptose.

The Nampa Waste Water Treatment Plant laboratory has used the MPN technique for determining fecal coliform bacteria in chlorinated secondary effluent since 1975. Problems were encountered in classifying tubes as positive or negative following the incubation period on occasions when few bub-

bles are present. The use of indicators to establish more definite tube results was investigated because fecal coliform bacteria produce acid in addition to gas when fermented in lactose. Brom cresol purple/l EC (0.0125 grams) was added to tubes sterilized by autoclaving for 15 minutes at 121C and duplicate inoculations from positive lauryl tryptose tubes were transferred to regular EC and the indicating EC. Thirty-four samples were run on dilutions of 0.01 ml to 1.0 milliliter/tube. At the end of incubation, there were 25 negative and 9 positive samples. Identical results were obtained in EC and indicating EC in all cases. Positive results changed the indicating EC from a dark purple to a yellowish green. Borderline positives changed to lavender, providing an observable determinant in addition to gas production. Small amounts of brom cresol purple indicator produced easily readable positive and borderline positive results. Tests were also conducted with EC indicators and lauryl tryptose presumptive fecal coliform tubes. These used duplicate series of nine tubes using 1.0 milliliters, 0.1 milliliters and 0.01 milliliters of sample. Results of five consecutive days showed identical numbers of fecal coliforms determined with or without brom cresol purple indicator. Interference was not caused by adding brom cresol purple to lauryl tryptose broth for more easily readable test results. (Collins-FIRL)
W77-07928

BIOLOGICAL REGENERATION OF AMMONIUM-SATURATED CLINOPTILOLITE. I. INITIAL OBSERVATIONS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-07942

BIOLOGICAL REGENERATION OF AMMONIUM-SATURATED CLINOPTILOLITE. II. MECHANISM OF REGENERATION AND INFLUENCE OF SALT CONCENTRATION,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-07943

A RAPID VOLUMETRIC METHOD OF DETERMINING FLUORINE IN WATER, (IN RUSSIAN),
Kiev Sanitary-Epidemiology Station (USSR).
A. T. Ivanova, B. M. Duchinskii, and O. I. Kovalenko.
Gig Sanit 6, p 57-59, 1976.

Descriptors: *Fluorine, *Pollutant identification, *Volumetric analysis, Analytical techniques, Indicators, Methodology, Water analysis.

A volumetric method of determining F levels in water is described. The method is based on the capacity of F to form a colorless complex with Zr which is more stable than the complex of Zr and the organic dye (sodium alizarin sulfonate) used as an indicator. The method can be used to determine the F in such resistant ions as SiF₂-6 and BF₄-.
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W77-07950

THE DETERMINATION OF NITRATES IN WATER, (IN RUSSIAN),
B. I. Fradkin.
Gig Sanit 6, p 94-95, 1976.

Descriptors: *Nitrates, *Pollutant identification, Nitrites, Photometry, Analytical techniques, Chemical analysis, Water analysis.

For the determination of nitrate levels in water, a method of nitrate reduction to nitrites and subsequent determination by Griess's reagent is described. The compounds are then analyzed photometrically. The method has a sensitivity of

0.035 mg nitrate N/ml and requires only 30 min for completion of the analysis.—Copyright 1977, Biological Abstracts, Inc.
W77-07966

MICROBIAL ATP STUDIES,
For primary bibliographic entry see Field 5C.
W77-07978

ELECTRON TRANSPORT ANALYSIS AS AN INDICATOR OF BIOLOGICAL OXIDATION IN FRESHWATER SEDIMENTS,
For primary bibliographic entry see Field 5C.
W77-07992

PLANKTONIC MICROBIAL HETEROTROPHY: ITS SIGNIFICANCE TO COMMUNITY BIOMASS PRODUCTION,
For primary bibliographic entry see Field 5C.
W77-07993

CHANGES IN THE PROPERTIES OF E. COLI UNDER THE INFLUENCE OF WATER ENVIRONMENTS,
I. Daubner.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2650-2657, 1975. 10 fig., 7 ref.

Descriptors: *Water pollution sources, *E. coli, *Physiological ecology, *Environmental effects, *Plant morphology, *Plant physiology, Pathogenic bacteria, Bioindicators, Biochemistry, Solid wastes, Pollutant identification.

The morphological and physiological integrity of pathogenic bacteria used as pollution indicators must be static if they are to be detectable and their effectiveness as a diagnostic tool not be impaired. However, it has been noted that different water qualities affect the morphology and physiology of these bacteria; therefore an investigation was made of the extent of the biological changes in *Escherichia coli* as affected by different solutions. Five to twenty hours after transferring *E. coli* to water, marked changes occurred. An initial observation showed shrinking of the cell and reduction of cytoplasmic content in distilled and surface water, or damage to the cell in a mineral medium. The formation of granules (possible ribosomal proteins) and separation of the cell wall from the cytoplasmic membrane were also observed. Respiration and dehydrogenase activity of the cells immediately decreased and corresponded with the mineral content of the water. Many changes were also observed in the biochemical activity of the cells, such as utilization of citrate as a sole carbon source, sucrose-splitting, hydrogen sulfate formation, gelatin-liquefying, and the negative methyl-red-test results. Fermentation of glucose at 37C and 43C, and formation of indol and Voges-Proskauer reaction was unchanged. (Auen-Wisconsin)
W77-07997

STUDY OF FREE LIVING AMOEBAE IN THE WATERS OF STRASBOURG: PRELIMINARY REPORT, (IN FRENCH),
Strasbourg Univ. (France). Inst. of Parasitology.
B. Molet, C. Derr-Harf, J. E. Schreiber, and M. Kremer.
Ann Parasitol Hum Comp 51(4), p 401-406, 1976.

Descriptors: *Potable water, *Water supply, Ponds, Swimming pools, Water pollution, *Pollutant identification, Isolation, Public health.
Identifiers: Acanthamoeba-Castellani, Acanthamoeba-Polyphaga, *Amoebae, France, Hartmannella-Vermiformis, Naegleria-Fowleri, Naegleria-Sp, Platyamoeba-Stenopodi, Saccamoeba-Sp, *Strasbourg(France), Vahlkampffia-Sp.

Free living amoebae (75 strains) were isolated from public drinking water supplies, swimming pools and official swimming ponds in Strasbourg, France. Only 42 strains were known previously. No pathogenic strain of *Naegleria fowleri* was found. *Acanthamoeba polyphaga*, *A. Castellani*, *Hartmannella vermiformis*, *Naegleria* sp., *Nahlkampia* sp., *Platyamoeba stenopodia* and *Saccamoeba* sp., were found.—Copyright 1977, Biological Abstracts, Inc. W77-08016

LIQUID SAMPLER,

For primary bibliographic entry see Field 7B. W77-08024

HYDROCARBONS IN EASTERN CANADIAN MARINE WATERS DETERMINED BY FLUORESCENCE SPECTROSCOPY AND GAS-LIQUID CHROMATOGRAPHY. Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab. P. D. Keizer, D. C. Gordon, Jr., and J. Dale. Journal of the Fisheries Research Board of Canada, Vol. 34, No. 3, p 347-353, March 1977. 6 fig, 1 tab, 14 ref.

Descriptors: *Canada, *Atlantic Ocean, *Oil, *Pollutant identification, *Chemical analysis, *Analytical techniques, *Oil pollution, Fuels, Oil industry, Water pollution, Water analysis, Chromatography, Gas chromatography, Fluorescence, Instrumentation, Organic compounds, Water pollution sources, Analysis.

Identifiers: *Bedford Basin(Canada), *Fluorescence spectroscopy, Alkanes, Marine environment.

In sea water off Atlantic Canada, sampling and analysis showed that concentrations of normal alkanes ranged from less than 20 ng/l to about 1 microgram/l at depths of 2 and 50 m. Estimated oil concentrations based on fluorescence analyses ranged from 0.2 to 9.3 microgram/l. The highest concentrations occurred in Bedford Basin; the similarity of fluorescence contour plots to petroleum products and the presence of unresolved envelopes in chromatograms suggest that a large portion of the hydrocarbons in the Basin are derived from oil. Hydrocarbons in other regions appear to be principally biogenic in origin. (Henley-ISWS) W77-08060

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, TECHNICAL SESSION PRESENTATIONS, WATER RESOURCES, VOLUME I-D. National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. For primary bibliographic entry see Field 7B. W77-08062

UTILIZATION OF LANDSAT DATA FOR WATER QUALITY SURVEYS IN THE CHOPTANK RIVER. General Electric Co., Beltsville, Md. J. M. Johnson, P. Cressy, and W. C. Dallam. In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2325-2330, September 1975. 15 fig, 3 tab, 4 ref.

Descriptors: *Water quality, *Monitoring, *Maryland, *Rivers, *Remote sensing, Surveys, Satellites(Artificial), Water analysis, Analytical techniques, Data processing, Chlorophyll, Sediment load, Reflectance. Identifiers: *LANDSAT, *Choptank River(Md), Spectral analysis.

Computer processing of LANDSAT-1 multispectral digital data demonstrated the applicability of

remotely sensed data to water quality survey in the Choptank River, Maryland. Water classes derived by automated analysis correlate to river nuisance levels of chlorophyll a and sediment loading as defined by the Maryland Department of Water Resources and the Corps of Engineers. Results indicated that an increase in chlorophyll a concentration corresponds, relative to MSS 5, to decreases in 4 and increases in 6 relative to the trends with increasing sediment load. It appears that for the purpose of water quality analysis, under favorable atmospheric conditions, only MSS 4, 5, and 6 are necessary. (See also W77-08062) (Humphreys-ISWS) W77-08072

ON THE RELATION OF THE DIATOM FLORA AND WATER QUALITY IN THE UJI RIVER KYOTO, (IN JAPANESE). Osaka Seikei Women's Jr. Coll. (Japan). Biology Lab. For primary bibliographic entry see Field 5. W77-08089

5B. Sources Of Pollution

MERCURY IN WATER, A BIBLIOGRAPHY, VOLUME 3. Office of Water Research and Technology. Washington, D. C. For primary bibliographic entry see Field 5A. W77-07605

MUTAGENIC POTENTIAL OF PETROLEUM BYPRODUCTS IN CHESAPEAKE BAY WATERS. Maryland Univ., College Park. Dept. of Microbiology. M. J. Voll, J. D. Isbister, L. I. Isaki, and M. D. McCommas.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 020. Price codes: A03 in paper copy, A01 in microfiche. Maryland Water Resources Research Center, College Park, Technical Report No. 39, March 1977. 36 p, 1 fig, 13 tab, 19 ref. OWRT A-034-MD(1). 14-34-0001-6021.

Descriptors: Oil, *Biodegradation, *Chesapeake Bay, *Bacteria, Sediments, *Oil pollution, *Oil wastes, Byproducts, Sampling, Assay, Pollutant identification, *Maryland. Identifiers: Mutagens, Colgate Creek(Md).

Chesapeake Bay water and sediment samples from an oil polluted area (Colgate Creek) and a relatively non-polluted area (Eastern Bay) were assayed by the Ames bacterial system for the presence of mutagenic substances. The samples examined were collected in October and November of 1975 and in March, May and June of 1976. Organic extracts and/or untreated samples were assayed. Results suggest but do not establish the presence of mutagenic substances in Colgate Creek water and sediment. Unfractionated oil biodegradation products produced by indigenous Colgate Creek water and sediment bacteria were also tested for mutagenicity. Colgate Creek water and sediment were inoculated into an inorganic salts medium containing one percent motor oil. Samples of the cultures were removed as a function of time of incubation and tested in the Ames bacterial system. Organic extracts or untreated samples were assayed. Mutagenic activity in the culture samples was not detected. It cannot, however, be concluded from the initial nature and limited scope of these studies that mutagenic oil biodegradation products are not produced. W77-07606

CYCLING OF DISSOLVED ORGANIC PHOSPHORUS COMPOUNDS IN NATURAL WATERS. Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering. For primary bibliographic entry see Field 5C. W77-07608

HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME 4, (ANALYTICAL METHODS FOR SEWAGE SLUDGE ANALYSIS). Toronto Univ. (Ontario). Inst. of Environmental Sciences. For primary bibliographic entry see Field 5A. W77-07614

EXAMINATION OF SEWAGE SLUDGE FOR ENTEROVIRUSES, VOLUME 2. Ontario Ministry of Health, Toronto. Lab. Services Branch. T. P. Subrahmanyam. Canada-Ontario Agreement on Great Lakes Water Quality, Research Report No. 52, Environmental Protection Service, Environment Canada, Ottawa, Canada, 35 p., 1 fig., 10 tab, 50 ref. 72-5-1.

Descriptors: *Viruses, *Pathogenic bacteria, *Sewage sludge, Soil contamination, Heavy metals, Environmental control, Sewage effluents, Agricultural runoff, *Monitoring, Hazards. Identifiers: *Enteroviruses, Poliovirus, Urban sewage, Rural land, Detection.

Spreading of sewage sludge on agricultural or grassland in rural areas carries an inherent risk of polluting the environment with harmful viruses and heavy metals contained in the sewage. Monitoring of sludge for viruses is, therefore, one important aspect of sewage disposal; first, to determine the extent of the problem, and second to ascertain the efficiency of present treatment methods in virus removal. This report deals with the first phase of the program at the Enterovirus Laboratory, Ontario Ministry of Health, Laboratory Services Branch, relating to spreading urban sewage sludge on rural land in Ontario. During April 1973 - December 1975, a total of 1317 specimens, including 642 sewage specimens, 540 raw and digested sludge specimens and 135 specimens of water were investigated. Out of the 444 specimens tested in 1973, 40% of the sewage specimens (48/124) contained virus, although the collection period included several cold months during which enteroviruses were not detected in the community. Virus isolation rates in 1974 and 1975 were lower, which paralleled the lower isolation rates from clinical cases as well. The virus isolates from sewage included several poliovirus isolates. Preliminary results indicate that at least one strain is definitely not derived from vaccine; a few others are intermediate in character, indicating that they too could be of nonvaccine origin. All the nonpolio enteroviruses found in this study are well-known human pathogens and, therefore, it is important to ensure that they are inactivated before sludge is spread on soil. (WATDOC) W77-07615

ENERGY DEVELOPMENT AND ITS EFFECT ON GROUND WATER. National Water Well Association, Worthington, Ohio. T. E. Gass. Water Well Journal, Vol. 31, No. 4, p 34-35, April, 1977.

Descriptors: *Energy, Oil wells, Oil wastes, Nuclear energy, Mine drainage, Pumps, *Water pollution, *Groundwater. Identifiers: Geothermal energy, Solar energy, Groundwater heat pumps.

Development of energy sources, even 'clean' energy sources, can consume and contaminate

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

large quantities of water. Improperly abandoned oil wells and test holes provide avenues for pollutants from the surface or from aquifers containing unpotable water to potentially useful ground water sources, while disposal of brines which frequently accompany oil production presents grave contamination problems as well. Petroleum refining process also requires vast amounts of water. Existing designs for solar energy systems that are economically feasible for large-scale production utilize a great deal of water for steam generation and cooling, and would strain the resources of the arid locations where sunlight is most constant and intense. Undesirable gases and dissolved solids associated with geothermal energy systems create waste disposal problems and require precautions to protect shallow water-bearing strata. Side effects of coal and nuclear energy development are well known as persistent water supply hazards. Widespread awareness of such water use and contamination problems and the increased implementation of alternative energy sources such as ground water heat pumps are important steps in finding solutions. (Eberle-NWWA)

W77-07691

RISK OF DRINKING WATER CONTAMINATION IN RURAL TENNESSEE, Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 5G.

W77-07701

SALTWATER-FRESHWATER INTERFACES IN THE "2,000-" AND "2,800-FOOT" SANDS IN THE CAPITAL AREA GROUND WATER CONSERVATION DISTRICT, Louisiana Capital-Area Ground Water Conservation Commission, Baton Rouge.
For primary bibliographic entry see Field 4B.

W77-07703

DISSOLVED GAS SUPERSATURATION, GRAND COULEE DAM PROJECT, 1973, Seattle Marine Labs., Seattle, Wash.
Prepared for Department of the Interior, Bureau of Reclamation, Boise, Idaho January, 1974. 82 p., 19 tab., 22 fig., 14 ref., 4 append.

Descriptors: *Columbia River, *Dams, Dam sites, *Grand Coulee Dam, On-Site investigations, *Nitrogen, *Supersaturation, Fish behavior, Water pollution effects, Water quality, Freshwater fish, Runoff, *Fish diseases, Sockeye salmon, Perch.
Identifiers: *Lake Roosevelt, *Banks Lake, *Upper Columbia River, *Gas bubble disease, *Chief Joseph Dam.

High nitrogen content (120%) was present in Columbia River waters entering Lake Roosevelt and the N₂ content only decreased 2-3%. Below Grand Coulee dam, nitrogen content reached 148% saturation in June. Fish inhabiting Banks Lake, (N₂ content of 115-120%), did not have signs of gas bubble disease, nor did fish residing below Grand Coulee Dam. (Katz)

W77-07722

ENZYME KINETICS--A REVIEW WITH EMPHASIS ON INHIBITION OF ENZYMES, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
J. Maguire.
Water Quality Branch, Scientific Series No. 47, 1974, 18 p., 12 fig., 61 ref.

Descriptors: *Enzymes, *Catalysts, *Hydrogen ion concentration, *Inhibition, Chemical reactions, Carbon dioxide, Amino acids, Biology, Proteins, Biochemistry, Reviews, *Cytological studies.
Identifiers: Enzymology, Chemical compounds, *Enzyme kinetics, Enzyme substrates, Molecules.

This review demonstrates the potential value of the application of the techniques of enzyme kinetics to environmental problems. Conclusions were: Whether enzymes in their natural state are in free solution or are insolubilized, many useful techniques may be employed to assess the effects of inhibitors, or changes in physical parameters, on enzyme-catalyzed reactions. Precise methods exist for determining whether a substance is an inhibitor of a particular enzyme reaction, how the substance inhibits the reaction, and how effective it is in relation to the substrate or other inhibitors. By varying other parameters such as PH it may be possible to deduce the site of binding of the inhibitor to the enzyme. With the knowledge of the mechanisms of enzyme action, specific effects of added chemicals on living organisms can be predicted. It may be possible, through judicious use of structure-activity relationships, to design compounds that are necessary as inhibitors of certain processes, but that are harmless to other systems. (WATDOC)

W77-07732

DEGRADATION OF PETROLEUM BY AN ALGA, PROTOHECA ZOPFII, Maryland Univ., College Park. Dept. of Microbiology.
For primary bibliographic entry see Field 5C.

W77-07737

MONITORING DISSOLVED HYDROCARBONS AS A FUNCTION OF THE TIDAL CYCLE (NEW YORK HARBOR), Coast Guard Research and Development Center, Groton, Conn.
W. E. McGowan.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A015 882 in paper copy, A01 in microfiche. U.S. Coast Guard Office of Research and Development, Final Report No. CG-D-106-75, April 1975. 37 p., 12 fig., 2 tab., 5 ref., 4 append.

Descriptors: *New York, *Monitoring, *Tidal effects, *Water pollution sources, *Oil pollution, Pollutants, Environmental effects, Measurement, Pollutant identification.
Identifiers: Outer Continental Shelf, Hydrocarbons, *New York Harbor.

Measurements of dissolved hydrocarbon (C₄-C₆) as a function of the tidal cycle are reported. Measurements were made in New York Harbor from 19 September to 5 October 1973 in order to evaluate a dissolved hydrocarbon monitoring system and to gain information about the behavior of dissolved pollutants in a tidal cycle. The trends of the relative data illustrate both the change in hydrocarbon concentration over the tidal cycle (as much as 6X) and the day-to-day variation of the coordinated tidal data. These data indicate that efficient and meaningful monitoring of the dissolved pollutants can be accomplished best with an understanding of the tidal pattern of the pre-existing pollutants. Such background information is essential for the following: to determine a sampling window in the tidal cycle which will appropriately reflect the pollutant input relative to the pre-existing levels; to interpret the extent and time frame of the increase due to the pollution incident; and to interpret possible irregularities in the surveillance data obtained during the sampling window. (Sinha-OEIS)

W77-07740

VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL, Delaware Univ., Lewes. Marine Studies Complex.
V. Klemas, G. Davis, and H. Wang.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-12444, Price codes: A02 in paper copy, A01 in microfiche. Report to NASA, Goddard Space Flight Center, Greenbelt, Md., October 1975. 2 p. NAS5-20983.

Descriptors: *Oil pollution, *Remote sensing, *Water pollution sources, Monitoring, *Oil spills, Model studies.
Identifiers: *Prediction models, LANDSAT satellites.

LANDSAT, aircraft, ships and air-dropped current drogues have been deployed to determine current circulation and to track oil slick movement on four different dates in Delaware Bay. The results were used to verify a predictive model for oil slick movement and dispersion. The model predicts the behavior of oil slicks given their size, location, tidal stage (current), weather (wind) and nature of crude. Both LANDSAT satellites provided valuable data on gross circulation patterns and convergent coastal fronts which by capturing oil slicks significantly influence their movement and dispersion. (Sinha-OEIS)

W77-07745

PRELIMINARY PROJECTIONS OF OIL SPILL MOVEMENT FOR THREE POTENTIAL DEEP-WATER PORT SITES IN THE GULF OF MEXICO, Coast Guard Research and Development Center, Groton, Conn.
I. M. Lissauer, and J. P. Welsh.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A024 331, Price codes: A03 in paper copy, A01 in microfiche. Final Report No. CG-D-19-75, December 1975. 36 p., 18 fig., 5 tab., 7 ref.

Descriptors: Water pollution sources, *Oil pollution, *Oil spills, *Gulf of Mexico, *Environmental effects, Sites, Wind velocity, Seasonal, *Path of pollutants.
Identifiers: *Deepwater ports, Trajectory, Prediction, Oil slicks.

Projections of the movement of oil slicks and their impact location along the shorelines of Texas, Louisiana, Mississippi, Alabama and Florida were determined from three potential deepwater port sites. Average monthly wind speeds and directions and average monthly current patterns were used for predicting the oil slick movement. Seasonal patterns of oil slick drift and probable areas of impact along the shoreline were indicated. (Sinha-OEIS)

W77-07753

BIOLOGICAL ASSESSMENT OF THE WATER QUALITY OF THE SMALL RIVERS SORA AND BYURYA (YENISEI BASIN), (IN RUSSIAN), Moscow State Univ. (USSR). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.

W77-07755

TAR BALL DISTRIBUTION IN THE WESTERN NORTH ATLANTIC, Coast Guard Research and Development Center, Groton, Conn.
W. E. McGowan, W. A. Saner, and G. L. Hufford.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A006 821, Price codes: A03 in paper copy, A01 in microfiche. Final Report No. CG-D-52-75, July 1974. 30 p., 6 fig., 3 tab., 6 ref., append.

Descriptors: *Oil pollution, *Water pollution sources, *Waste disposal, Seepage, Monitoring, *Distribution patterns, *Path of pollutants, *Atlantic Ocean.
Identifiers: *Tar balls, *Western North Atlantic Ocean.

Surface waters of the Atlantic Ocean were quantitatively sampled for floating tar balls from December 1971 to September 1973. It was found that tar ball concentrations generally increase from the Labrador Sea at ocean station Bravo (nearly tar ball free) south to the Sargasso Sea at

ocean station Echo. This south to north decrease in tar pollution was not only noted for the four ocean station sampling areas, but was also observed along the eastern coast of the United States. Analysis of thirty-five tar ball samples for iron indicated high levels of Fe203. This implies previous association of the tar balls with iron or steel and suggests that man-made sources are partially responsible for tar ball pollution in addition to natural oil seeps. (Sinha-OEIS)
W77-07757

TRANSPORT OF REACTIVE SOLUTES THROUGH MULTILAYERED SOILS.
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-07758

SOLUTE MOVEMENT IN A FIELD SOIL.
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W77-07759

MODEL OF SALT FLOW IN SOIL WITH A SOURCE-SINK TERM.
Utah State Univ., Logan. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-07761

REPRESENTATIVE AND EXPERIMENTAL BASINS - WHERE NEXT.
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2A.
W77-07781

LIMNOLOGIC-GEOLOGIC EXCURSION IN THE TERRITORY OF THE LOWER ERFT RIVER, (IN GERMAN).
Landesanstalt fuer Gewaesserkunde und Gewaesserschutz Nordrhein-Westfalen, Krefeld (West Germany).
G. Friedrich, and K. N. Thome.
Decheniana 129, p 268-272, 1976.

Descriptors: *Hydrogeology, *Coal mines, *Strip mines, Iron compounds, Algae, *Iron, Aquatic life, Diptera, Larvae, Isopods, Diatoms, Rivers, *Mine wastes, Water pollution.
Identifiers: Asellus-aquaticus, Asellus-coxalis, Bithynia-tentaculata, Cladophora-glomerata, Compositopogon-hookeri, Dendrocoelum-lactum, Dugesia-tigrina, Herpobdella-octoculata, Limnephilid, Lumnaea-ovata, Oedogonium, Capillare, Oscillatoria-splendida, Physa-acuta, Physa-fontinalis, Planarea-lugubris, Potamogeton-natans, Potamogeton-pectinatus, Ranunculus-fluitans, Sparganium-erectum, Stigeoclonium-tenuis, Ulothrix-tenerrima, West Germany(Erft River).

The geography and hydrology of the area of the excursion are described. There is much damage due to brown coal strip mining operations. Ground water was drained through a canal leading to the Erft River. The water in nearby springs is rich in Fe which repels plant life. The canal contains only a few blue algae (Oscillatoria splendida) and filamentous green algae (Ulothrix tenerrima) which tolerate high Fe concentrations. The Erft shore plant population includes Sparganium erectum, Potamogeton natans, P. pectinatus and Ranunculus fluitans. On flowering plants and stones, diatoms, various green algae (Cladophora glomerata, Stigeoclonium tenue, Oedogonium capillare) and the tropical red alga Compositopogon hookeri were found. The macrozoobenthos is composed mainly of snails (Bithynia tentaculata, Lumnaea ovata, Physa fontinalis, P. acuta and worms of North American origin (Dugesia tigrina, Dendrocoelum lactum and Planaria lugubris). The Isopoda included Asellus coxalis and A. aquaticus. Leeches (Herpobdella octoculata) and insect larvae (Chironomids, Limnephilids) were also found.—Copyright 1977, Biological Abstracts, Inc.

W77-07799

DETERMINATION OF THE LEEWAY OF OIL SLICKS.
Virginia Inst. of Marine Science, Gloucester Point. C. L. Smith.
U.S. Coast Guard Office of Research and Development Final Report No. CG-D-60-75, August 1974. 48 p, 11 fig, 5 tab, 33 ref, append. Also as: Virginia Institute of Marine Science Contribution No. 644. DOT-CG-33, 183A

Descriptors: *Water pollution sources, *Oil spills, *Oil pollution, Weather, Wind velocity, Forecasting, *Path of pollutants.
Identifiers: Oil slicks.

The leeway of oil slicks was determined as a function of wind velocity in its range 5-25 knots to enable more precise forecasting of the trajectory of oil spills, and thus aid effective containment and cleanup operations. Leeway was calculated by measurement of the separation of oil slicks from a dyed patch of surface water at sea, using time-sequenced nadir aerial photography. Five oil types, Nos. 2, 4, and 6 fuel oils, and light and heavy crude oils, were found to exhibit similar leeway as a function of wind speed. Oil spill volume had no measurable effect on leeway, and slicks moved in the direction of the wind. The leeway increases with sea state, and obeys a linear relationship with wind velocity in the wind range studies (Sinha-OEIS)
W77-07800

DEGRADATION OF SODIUM DODECYLSULFATE BY BACTERIA IN WASTE WATERS, (IN RUSSIAN).
Akademiya Nauk USSR, Kiev. Inst. of Colloidal Chemistry and Water.
S. S. Stavskaya, N. A. Yaroshenko, L. A. Taranova, and S. G. Yushmanko.
Gidrobiol Zh 12(3), p 91-93, 1976.

Descriptors: *Bacteria, *Biodegradation, *Sulfates, Sodium, Surfactants, Water pollution control, Pollution abatement.
Identifiers: *Aerobacter-aerogenes, *Citrobacter-freundii, *Sodium dodecylsulfate.

To identify bacterial strains responsible for degrading surfactants and to determine the optimal conditions for this degradation, Citrobacter freundii and Aerobacter aerogenes, isolated from the waste waters of a detergent production plant, were studied. Degradation of the anionic synthetic surfactant sodium dodecylsulfate by a mixed culture of the bacteria was more efficient after shaking than under stationary conditions. C. freundii was the species responsible for the degradation of the surfactant, and A. aerogenes evidently utilized the degradation products.—Copyright 1977, Biological Abstracts, Inc.
W77-07801

A REVIEW AND EVALUATION OF BASIC TECHNIQUES FOR PREDICTING THE BEHAVIOR OF SURFACE OIL SLICKS.
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
K. D. Stolzenbach, O. S. Madsen, E. E. Adams, A. M. Pollack, and C. K. Cooper.
Sea Grant Program Report No. MITSG-77-9, Index No. 77-308-Cfn, March 1977. 323 p.

Descriptors: *Water pollution sources, *Oil pollution, Advection, *Forecasting, *Oil spills, *Path of pollutants, Model studies, Bibliographies, *Reviews, Evaluation.
Identifiers: *Oil slicks, Wind driven currents, Wind fields.

When an oil spill occurs, protective measures to minimize impacts require a capability to forecast

the short-term and long-term behavior of the spilled oil. The motivation presented in this report is the need for a detailed review of the basic analytical techniques available for making such predictive estimates. Because of its significance in determining the fate of oil slicks, the representation and determination of wind fields is discussed first. Then a treatment of the advection of oil slicks that is brought about by the combined action of currents and wind-waves is presented. Following this, the various physical phenomena that transform an oil slick as it is being advected is discussed. Finally a review and evaluation of existing models for oil slick behavior is presented. A comprehensive bibliography is included along with an appendix containing a detailed treatment of wind driven currents. (NOAA)
W77-07808

MODELING NONPOINT POLLUTION FROM THE LAND SURFACE.
Hydrocomp Inc., Palo Alto, Calif.
A. S. Donigan, Jr., and N. H. Crawford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 089, Price codes: A13 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-76-083, July 1976. 279 p., 42 tab., 52 fig., 82 ref.

Descriptors: North Carolina, Wisconsin, Washington, *Water pollution sources, Methodology, On-site investigations, *Model studies, *Simulation analysis, *Runoff, Runoff forecasting, Hydrology, Water quality, Snowmelt, *Land use, *Mathematical models, *Sediment discharge, *Path of pollutants.
Identifiers: Durham(NC), Madison(Wisc), Seattle(Wash), *Nonpoint pollution, Urban runoff, Pollutant contributions, *Sediment runoff.

Development and initial testing of a mathematical model to continuously simulate pollutant contributions to stream channels from nonpoint sources is presented. The Nonpoint Source Pollutant Loading (NPS) Model is comprised of subprograms to represent the hydrologic response of a watershed, including snow accumulation and melt, and the processes of pollutant accumulation, generation, and washoff from the land surface. The simulation of nonpoint pollutants from both pervious and impervious areas is based on sediment as a pollutant indicator. The calculated sediment washoff is multiplied by user-specified "potency factors" that indicate the pollutant strength of the sediment for each pollutant simulated. Both urban and rural areas can be simulated. Initial testing of the NPS Model was performed on three urban watersheds in Durham, North Carolina; Madison, Wisconsin; and Seattle, Washington. The hydrologic simulation results were good while the simulation of nonpoint pollutants was fair to good. Sediment, BOD, and 55 were the major pollutants investigated. A detailed user manual is provided to assist potential users in application of the NPS Model. Parameter definitions and guidelines for parameter evaluation and calibration are included. Possible uses of the NPS Model for evaluation of nonpoint pollution problems are discussed. (Katz)
W77-07818

BENZENE SOURCES OF CONTAMINATION, AMBIENT LEVELS, AND FATE OF BENZENE IN THE ENVIRONMENT.
Syracuse Univ. Research Corp., N.Y. Life Sciences Div.
P. H. Howard, and P. R. Durkin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 139, Price codes: A04 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA/600/5-75-005, Dec. 1974. 65 p., 15 tab., 3 fig., 11 refs.

Descriptors: *Organic compounds, *Public health, *Path of pollutants, Environmental effects,

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Group 5B—Sources Of Pollution

*Degradation(Decomposition), Oil spills, Oil pollution, Oil industry, Industrial wastes, *Monitoring, Analytical methods, Microbiology, Microbial degradation, Water pollution effects. Identifiers: *Benzene, *Automotive emissions, *Automotive wastes, Motor vehicle emission, *Environmental persistence, Ambient levels, Environmental transport, Ultra violet absorption, Spectra, Benzene derivatives, Microbiological decomposition.

Available information pertinent to an assessment of benzene contamination of the environment is reviewed and evaluated. Benzene losses from commercial (production and use) and non-commercial (automotive emissions and oil spills) sources were considered. It is estimated that of the total quantity that is released to the environment more than half results from motor vehicle emissions. Monitoring data somewhat support this contention. Available information on the environmental persistence of benzene suggests that it degrades slowly. (Katz). W77-07819

RUM JUNGLE ENVIRONMENTAL STUDIES, SUMMARY REPORT,
Australian Atomic Energy Commission Research Establishment, Lucas Heights.
G. M. Watson.
Report AAEC/E366, Sept. 1975, 3 tab., 1 fig.

Descriptors: *Australia, *Mine wastes, *Mineral industry, Industrial wastes, Water pollution effects, Metals, Liquid wastes, *Radioactive waste disposal, *Radium, Radioisotopes, Seasonal, *Uranium radioisotopes, On-site investigations, Fishkill, Freshwater fish, Copper, Zinc, Manganese, Seasonal, *Water pollution sources, *Path of pollutants.
Identifiers: *Rum Jungle(Australia), Seasonal variations.

Sources of pollution were identified and their relative importance assessed. Observations were made on seasonal variations and differences were noted between the dispersion patterns of several metals of interest. The geographical extent of chemical and biological pollution was examined. Some understanding of the basic mechanisms involved in continuing pollution was obtained and an attempt was made to determine the fate of heavy metals. (Katz)
W77-07822

MERCURY IN THE BIOGEOCHEMICAL ENVIRONMENT,
Stanford Univ., Calif. Dept. of Applied Earth Sciences.
G. A. Parks, P. L. McCarty, and J. O. Leckie.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 137, Price codes: A03 in paper copy, A01 in microfiche. Mercury Project, Stanford University, Report NSF-RA-E-74-020, October 1974, 81 p., 4 fig., 108 ref.

Descriptors: *Mercury, Water pollution effects, *Path of pollutants, *Transfer, *Transport depletion, Pollution abatement, Industrial wastes, Industrial water, Water pollution control, *Water pollution sources, Water pollution treatment, California, Hydrogen ion concentration, Acidic water, Aquatic environment.
Identifiers: *Pollution fixation, *Pollution control methods, *Pollution dispersal, *Biogeochemical environment, New Almaden, San Francisco Bay, Methylmercury.

The dispersal and effects of mercury in the environment is reported. The stages of the investigation reported on include: (1) determination of the types of sources and sinks and the location of probable important fluxes of mercury in areas chosen to include typical problem environments and (2) description and modelling of release, trans-

port and fixation processes in typical environments. Opportunities for pollution control are identified and the design and feasibility analysis of pollution control methods are discussed. (Katz)
W77-07823

ULTRASTRUCTURAL STUDY OF LESIONS IN GILLS OF A MARINE SHRIMP EXPOSED TO CADMIUM,
Environmental Research Lab. Gulf Breeze, Fla.
For primary bibliographic entry see Field 5C.
W77-07845

AQUATIC INSECT DIVERSITY AND BIOMASS IN A STREAM marginally POLLUTED BY ACID STRIP MINE DRAINAGE,
Pennsylvania State Univ., University Park. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-07846

A STUDY ON THE STRENGTH OF SEWAGE,
T. Stones.
Effluent and Water Treatment Journal, Vol 17, No 2, p 90-91, February, 1977, 3 tab, 11 ref.

Descriptors: *Sewage, Physical properties, Chemical properties, *Oxygen demand, Oxidation, Biochemical oxygen demand, Chemical oxygen demand, Industrial wastes, Domestic wastes, Chemical reactions, Analysis, Pollutant identification, Water pollution sources.
Identifiers: Sewage strength, *Carbonaceous oxygen demand, *Nitrogenous oxygen demand.

The strength, or oxidizable matter concentration of sewage was characterized on the basis of its oxygen demand. This oxidizable matter is composed chiefly of carbonaceous and nitrogenous compounds. The absolute strength of sewage was defined as the dissolved oxygen needed for complete biochemical oxidation of the organic matter. Complete oxidation occurs in two stages: oxidation of carbonaceous matter and of nitrogenous matter. The lengthy time needed for this process required that other criteria be adopted to make the strength determinations. Carbonaceous oxygen demand can be determined by the dichromate value (DV) or COD by measuring oxygen consumption from silver catalyzed dichromate. This varies with the nature of the sewage. Nitrogenous oxygen demand can be calculated from the unoxidized nitrogen present according to a stoichiometric relationship. A formula was given for the determination of total, carbonaceous, and nitrogenous oxygen demand. (Collins-FIRL)
W77-07853

NITRATES IN SOME SOIL-WATER SYSTEMS IN QUEBEC, (IN FRENCH),
E. Chamberland.
Can J Soil Sci 56(3), p 257-269, 1976.

Descriptors: *Nitrates, *Canada, Corn(Field), Climates, Soils, *Soil analysis, Soil chemistry, Nitrogen, Fertilization, *Path of pollutants, Water pollution.
Identifiers: *Quebec.

Soil and water table nitrate concentrations were followed in test plots and fields seeded to corn (Zea mays L.) located in SW Quebec (Canada) during 1971-73. Soil samples were taken to a depth of 150 cm in 25 cm intervals. Although there were few sites where nitrate concentrations exceeding 10 ppm were found in mineral soils, they were as high as 70 ppm in organic soils. Nitrate accumulation observed in 1972 changed to a near disappearance in 1973. This effect was ascribed to changes in climatic conditions. N fertilization levels ranged 50-300 kg N/ha and reached a maximum of 600 kg N/ha over 2 yr. These had a significant influence on soil nitrate concentrations. The observed soil nitrate concentration did not exceed

40 ppm with the 200 kg N/ha rates in 1971. N fertilization did not contribute significantly to groundwater nitrate concentrations, and mean N levels (NO₃+ NO₂) were 4.5 mg/l in the spring, 12.7 in July and 0.8 in Sept. 1973. N levels greater than 10 mg/l were found only once in 2 soils. Soil nitrate concentrations were low because of the approximately 112 kg N/ha N levels as used by corn growers.—Copyright 1977, Biological Abstracts, Inc.
W77-07858

HYDROCHEMISTRY OF THE NIGULA SWAMP, (IN ESTONIAN),
Akademiya Nauk Estonskoi SSR, Tartu. Inst. of Zoology and Botany.
For primary bibliographic entry see Field 2H.
W77-07859

EFFECTS OF TRACE ELEMENTS ON NITROGEN MINERALIZATION IN SOILS,
Iowa State Univ., Ames. Dept. of Agronomy.
C. N. Liang, and M. A. Tabatabai.
Environmental Pollution, Vol. 12, No. 2, p 141-147, February, 1977, 3 tab, 18 ref.

Descriptors: *Trace elements, *Metals, *Soil types, *Mineralogy, Sludge disposal, Organic matter, Toxicity, Chemical properties, Physical properties, Microorganisms, *Nitrogen.

Soil trace element content was studied to determine the effects on nitrogen mineralization. Soils studied were surface soils at depths of 0-15 centimeters with a pH range of 5.8-7.8; an organic matter content of 2.58-5.45% organic carbon; and textures of 23-45% clay, 39-54% silt, and 1-38% sand. Results were obtained after a 20-day incubation period. Nineteen trace elements were studied, showing Ag(I) and Hg(II) to be the most effective inhibitors, and Co(II), As(III), S(IV), and W(VI) to be the least effective inhibitors of nitrogen mineralization in the soils. Chemical and physical characteristics of the soils as well as the nature of nitrogen in them have a great effect on the inhibition of nitrogen mineralization by trace elements. The degree of effectiveness of the remaining elements varied. The toxicity of Ag(I), Hg(II), Cu(II), and Cd(III) might have been caused by an ionic reaction with sulphhydryl groups of the enzyme systems of the microorganisms involved in nitrogen mineralization. No nitrite nitrogen was detected and this suggested that there was no inhibition of Nitrobacter under the conditions of the experiment. Small amounts of chloride and sulfate ions associated with trace elements were not likely to stimulate or depress nitrogen mineralization in these experiments. It was concluded that the accumulation of trace elements in soils could cause a reduction of the nitrogen available to plants in soil organic matter. (Collins-FIRL)
W77-07864

ORGANIC MATTER AND HEAVY METAL UPTAKE,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-07870

LAKES WILL TAKE THE POLLUTION LOAD OFF OLD FATHER TAME,
For primary bibliographic entry see Field 5G.
W77-07913

RELATIONSHIP BETWEEN BODS AND FATS, OILS AND GREASE,
Environmental Protection Agency, Springfield, Ill.
For primary bibliographic entry see Field 5G.
W77-07925

ISRAEL'S USE OF NONIONIC SURFACTANTS, Technion - Israel Inst. of Tech., Haifa. Environmental Engineering Labs. N. Narkis, and S. Henefeld-Furie. *Water and Sewage Works*, Vol. 124, No. 3, p 69-71, March, 1977. 3 tab, 22 ref.

Descriptors: *Surfactants, *Foaming, *Water pollution sources, Detergents, Domestic wastes, Industrial wastes, Pulp and paper industry, Textiles, Pesticides, Chemical properties, Physical properties, *Waste water treatment, Toxicity, Water pollution control.
Identifiers: *Nonionic surfactants, *Israel.

The use of nonionic surfactants in Israel was discussed. About 2,300 tons of these materials are used annually in Israel. They are predominantly nonyl phenol and di-nonyl phenyl ethoxylates and are poorly degradable during waste water treatment. Ten to thirty percent removals are usual. Important properties of these surface active agents are that they are neutral, Harmless to the skin, stable and effective in high concentrations of salts, suitable to high and low temperature applications, and are not affected by hardness or extreme pH levels. Their use as cleaners in households, and in textile, paper-making, metal, and pesticide industries has increased their presence in waste water. Detection of synthetic surfactants in water and waste water is based on the reaction of methylene blue with the anionic part of the molecule forming chloro form soluble salts. Conventional techniques cannot determine the presence of nonionic surfactants. They cause serious foaming problems and interfere with sewage treatment, as well as being toxic to fish. Research should be conducted to find effective means for their removal from waste water and sewage treatment effluents. (Collins-FIRL)
W77-07929

THREE CASE STUDIES ON THE APPLICATION OF THE STORM WATER MANAGEMENT MODEL, Metcalf and Eddy, Inc., Boston, Mass. J. P. Vittands.

In: Short Course Proceedings: Applications of Storm Water Management Models, August 19-23, 1974, Amherst, Massachusetts, University of Massachusetts, Amherst, p 280-332. 19 fig, 12 tab.

Descriptors: *Model studies, *Water management (Applied), Analysis, Evaluation, Overflow, Water pollution sources, Pollution abatement, Sewerage, Combined sewers, Planning, Cities, Ohio, Massachusetts.
Identifiers: *Storm Water Management Model, Cleveland(Oh), Middleton(Oh), Boston(Mass).

Three case studies are presented which employ the Storm Water Management Model. These involved sewer system modeling and improvements in Cleveland, Ohio; combined sewer overflow regulation in Middletown, Ohio; and combined sewer overflow regulation in metropolitan Boston, Massachusetts. For the purposes of the first study, only parameters for the quantification of pollutants needed to be added in order to use the model as an aid in determining alternative remedies for combined sewer overflows. The technique used was design by analysis with computer simulation employed to determine conditions in a sewer system during a storm. For the second study, dry-weather flows, wet-weather flows, and other data were combined to conduct a comprehensive engineering evaluation of pollution abatement relative to combined sewer overflows to the Great Miami River within Middletown. The model was used in the metropolitan Boston area to assess the combined sewer overflow problem and to determine possible means for pollution abatement during the planning process for sewer development during the next 80 years. About 24,000 acres of combined and separate sewerages were modeled to quantify combined sewer overflow pollution in terms of quality of discharge and

amount of pollutants represented by BOD, suspended solids, and coliform bacteria. (W77-07066) (Collins-FIRL)
W77-07955

MIGRATION OF 90SR WITH RUNOFF WATERS FROM SOILS, (IN RUSSIAN), F. Y. Rovinskii, Z. L. Sinitsyna, and P. Y. Cherkhanov. *Pochvovedenie* 8, p 52-55, 1976.

Descriptors: *Path of pollutants, *Strontium radioisotopes, Soils, Water pollution sources, Runoff, Sands, Clays.
Identifiers: Strontium-90.

By modeling under laboratory conditions, a contaminated soil layer from which 90Sr was leached with runoff slope waters was determined. A maximum coefficient of the 90Sr runoff was found for sand and clay.—Copyright 1977, Biological Abstracts, Inc.
W77-07971

EXPERIMENTAL STUDY OF THE ACTION OF PESTICIDES ON THE MICROFLORA OF BODIES OF WATER, (IN RUSSIAN), Nauchno-Issledovatel'skii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR). E. P. Aleshnya. *Gig Sanit* 6, p 97-99, 1976.

Descriptors: *Pesticides, *E. coli, Bacteria, Microorganisms, Self purification, Water pollution, *Euteric bacteria.
Identifiers: Bacilli, *Chlorophos, *Enterococci, *Propanide, Saprophytic.

Propanide in a concentration of 200 mg/l river water had a bacteria effect on intestinal bacilli, fecal *Escherichia coli* and enterococci; a 20 mg/l concentration had a bactericidal effect on fecal *E. coli* and enterococci and a bacteriostatic effect on the intestinal bacilli. In concentrations of 5-500 mg/l river water, chlorophos had a stimulating effect on all 3 groups of microorganisms. After an initial stimulation of growth during high (500 mg/l) chlorophos concentrations, a sharp decrease in microorganisms was noted by the 9th day of the experiment, probably due to pH changes. The total number of saprophytic microflora increased under the effect of the studied pesticides, most often on the 2nd day, which may indicate a period of adaptation to the pesticides. Thus in certain concentrations, chlorophos and propanide disturbed bacterial processes of self-purification of water.—Copyright 1977, Biological Abstracts, Inc.
W77-07982

VISUAL OBSERVATIONS OF PHOSPHORUS MOVEMENT BETWEEN ALGAE, BACTERIA, AND ABIOTIC PARTICLES IN LAKE WATERS, Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section. For primary bibliographic entry see Field 5C.
W77-07983

LOW FREQUENCY TURBULENCE AND VERTICAL TEMPERATURE MICROSTRUCTURE IN LAKE TAHOE, CALIFORNIA-NEVADA, For primary bibliographic entry see Field 2H.
W77-07984

PHOSPHORUS: CHANGES IN ECOSYSTEM METABOLISM FROM REDUCED LOADING, For primary bibliographic entry see Field 5C.
W77-07989

THE EFFECT OF HIGHWAY DEICING SALT ON CHLORIDE BUDGETS AT LAKE GEORGE, NY, Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.

G. S. Lipka, and D. B. Aulenbach. FWI Report 76-2, 1976. 17 p, 4 fig., 2 tab., 8 ref.

Descriptors: *Highway effects, *Deicers, *Highways, *Sodium chloride, Surface waters, Groundwater, Precipitation (Atmospheric), *New York, Seasonal, Highway icing.
Identifiers: *Lake George (NY).

A study was made of the impact of highway deicing salt on the water quality of Lake George, New York, and three stream basins, two adjacent to the southern end of the lake and one remote basin on the east shore. It was apparent that peaks in chloride delivery rates were associated with peak stormflows as the highest sustained delivery rates were noted in the late spring and early summer and the highest instantaneous deliveries were noted during snowmelt and highway runoff in late winter and early spring. Because Lake George itself showed no variation in chloride concentration with depth, there is no density gradient potential for inhibiting overturn and density imposed stratification is not expected with the present highway system. Although highway deicing salts apparently do have a significant effect on chloride budgets in streams, no adverse water quality impacts were found. However, a potential for groundwater contamination by deicing salt in areas of gentler slopes and poorer soil drainage does exist as a high percentage of deicing chlorides apparently enter the local groundwater; there also appeared to be a wintertime increase in chloride precipitation. (Auen-Wiscinson)
W77-08000

THE PROBLEM OF THE SANITARY PROTECTION OF THE WATERS OF PORTS AND COASTAL ZONES OF THE BLACK SEA BASIN, (IN RUSSIAN), Black Sea-Azov Watershed Basin Sanitary Epidemiology Station, Odessa (USSR). For primary bibliographic entry see Field 5G.
W77-08014

THE PROBLEM OF THE BEHAVIOR OF CHEMICAL POLLUTANTS IN THE ENVIRONMENT, (IN RUSSIAN), P. Kol'kovskii. *Gig Sanit* 6, p 73-77, 1976.

Descriptors: *Pollutants, *Chemical wastes, Industrial wastes, *Environment, *Path of pollutants, Water pollution effects, *Abiotic environment.
Identifiers: *Biotic environment.

The behavior of chemical pollutants in the environment and the effect of abiotic and biotic factors on this behavior are analyzed. A schematic representation of the mechanism of the migration of chemical pollutants in the environment is presented and discussed.—Copyright 1977, Biological Abstracts, Inc.
W77-08028

HYGIENIC CRITERIA OF THE COMPLEX ACTION OF CHEMICAL ENVIRONMENTAL POLLUTANTS, (IN RUSSIAN), Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene. For primary bibliographic entry see Field 5G.
W77-08029

USE OF STATE ESTIMATION TECHNIQUES IN WATER RESOURCE SYSTEM MODELING, BY DENNIS P. LETTENMAIER AND STEPHEN J. BURGESS, International Inst. for Applied Systems Analysis, Laxenburg (Austria). A. Szollosi-Nagy. *Water Resources Bulletin*, Vol. 13, No. 1, p 161-167, February 1977. 26 ref.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5B—Sources Of Pollution

Descriptors: Water resources development, *Model studies, *Water quality, Measurement, Design, Estimating, Equations, Algorithms, Systems analysis, *Biochemical oxygen demand, *Filters, Filtration.
Identifiers: *State estimation, *Kalman filters, Linear systems, Divergence, Measurement matrix.

Discussed is Lettenmaier and Burges' paper (see W76-07143), an illustration of the potential use of State Estimation techniques in water resources modeling; the paper gives background theory for linear and extended Kalman Filters and describes application of the filter techniques to modeling BOD and oxygen deficit in a stream. From a general viewpoint, Szollosi-Nagy criticizes that the paper does not fulfill its objectives: the article is no help to the novice, since it is filled with misleading explanations as well as with inconsistent notations. Secondly, the authors do not refer to a number of very relevant articles in this field, thereby failing to adequately suggest examples of applications of the technique to water resources problems. Next, Szollosi-Nagy presents a more detailed, highly critical, discussion with basically no praise. He feels that the authors do not precisely describe the general state estimation problem. Next, he comments on errors dealing with the measurement matrix. He believes that the authors should have shown how the recursive formulas of the linear Kalman filter are obtained and how they can be interpreted from an engineering point of view, rather than giving elaborate details on the extended Kalman filtering. The only merit the paper deserves, concludes Szollosi-Nagy, is that it is, to his knowledge, the first paper ever published in Water Resources Bulletin on state estimation techniques in water resources modeling. (Bell-Cornell)
W77-08035

INFLUENCE OF MUSSEL METABOLITES ON THE DYNAMICS OF NUTRIENTS IN THE COASTAL WATERS OF THE EASTERN MURMAN COAST, (IN RUSSIAN), Murmanskii Morskoi Biologicheskii Institut (USSR).
For primary bibliographic entry see Field 5C.
W77-08043

APPLICATION OF THERMAL SCANNING TO THE STUDY OF TRANSVERSE MIXING IN RIVERS, Wisconsin Univ., Madison.
J. W. Eheart.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, Houston, Texas, p 2317-2324, September 1975. 32 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Remote sensing, *Model studies, *Rivers, *Mixing, Mathematical models, Water temperature, Thermal pollution, Dispersion, Analytical techniques, Water pollution, Biochemical oxygen demand, Application methods.
Identifiers: Heat transport, Mass transport.

It was considered desirable to study and to predict the two-dimensional movement of pollutants in the region just downstream of a pollutant discharge point. While many of the more common pollutants do not exhibit a spectral signature, it was shown that the temperature difference between the pollutant and the receiving water could be successfully exploited by applying a mathematical model of mass transport processes to heat transport and then testing and calibrating it with thermal scanning data. (See also W77-08062) (Humphreys-ISWS)
W77-08071

5C. Effects Of Pollution

CYCLING OF DISSOLVED ORGANIC PHOSPHORUS COMPOUNDS IN NATURAL WATERS, Illinois Inst. of Tech., Chicago. Dept. of Environmental Engineering.
H. E. Allen, T. D. Brisbin, and K. O. Thomsen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 105, Price codes: A03 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 120, March 1977, 20 p, 4 tab, 14 ref. OWRT A-078-ILL(1).

Descriptors: *Phosphorus compounds, *Cycling nutrients, *Organophosphorus compounds, Enzymes, Assay, Mineralogy.
Identifiers: *Soluble organic phosphorus, *Phosphorus cycle, Alkaline phosphatase, *Phytase, *Protease, Lipase, Phosphatase.

Characterization of soluble phosphorus by enzymatic assays was conducted to determine if protease and/or lipase in conjunction with phytase or alkaline phosphatase would promote the remineralization of organic phosphorus. Results are presented determining which enzymes are factors to be considered in the phosphorus cycle. It was determined that 88 micro-g/l of the initial total 175 micro-g/l organic phosphorus in the concentrated lake water sample was phytase hydrolyzable, and that 21 micro-g/l of the organic phosphorus was alkaline phosphatase hydrolyzable. The difference of 67 micro-g/l between phytase and alkaline phosphatase hydrolyzable material is due to phytic acid present in the concentrated lake water. Phytic acid represents 38 percent of the total organic phosphorus in the concentrated lake water. Protease released 58 micro-g/l orthophosphate from the organic phosphorus in the concentrated lake water. This release indicates that 38 percent of the organic phosphorus is protease hydrolyzable. Concentrated lake water incubated with protease, prior to phytase incubation, released 171 micro-g/l orthophosphate from the organic phosphorus, representing 98 percent of the total organic phosphorus material. An additional release of 35 micro-g/l orthophosphate was found when the sample was incubated with protease prior to incubation with phytase. Concentrated lake water incubated with protease prior to incubation with alkaline phosphatase released 97 micro-g/l orthophosphate from the organic phosphorus. An additional release of 18 micro-g/l orthophosphate was found when the sample was incubated with protease prior to alkaline phosphatase. The difference between the additional release by protease followed by phytase and protease followed by alkaline phosphatase is 17 micro-g/l, which is phytic acid or phytic acid-like material. These results indicate that organic phosphorus can be characterized by enzymatic assays. The enzymatic procedure determines both the phytase available and the initially phytase unavailable phytic acid component of the organic phosphorus pool. This methodology should permit better definitions of the components in both the rapidly and the slowly cycling organic phosphorus.
W77-07608

EXPERIMENTAL DATA FOR THE HYGIENIC STANDARDIZATION OF DIPHENYLAMINE AND DIPHENYLDIETHYLUREA IN WATER BODIES, (IN RUSSIAN), Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene.
For primary bibliographic entry see Field 5G.
W77-07700

DECOMPRESSION - INDUCED BUBBLE FORMATION IN SALMONIDS: COMPARISON TO GAS BUBBLE DISEASE, Washington Univ., Seattle. Fisheries Research Inst.

D. L. Beyer, B. G. D'Aoust, and L. S. Smith.
Undersea Biomedical Research, Vol. 3(4), p 321-338, 1976. 3 tab., 9 fig., 19 ref.

Descriptors: *Fish diseases, Pathology, *Fish physiology, Fish behavior, Fish hatcheries, *Supersaturation, *Gases, *Salmonids, Bioassays, Laboratory tests, *Bubbles, Freshwater fish, *Depths, Pressure, Mortalities, Methodology, Juvenile fish.
Identifiers: *Decompression, *Gas bubble disease, Inert gas, Elimination, Gas solubility, Coho salmon, *Bubble formation.

The relationship of gas bubble disease (GBD) in fish to decompression-induced bubble formation was investigated with salmonids. Acute bioassays were used to determine equilibration times for critical effects in fish decompressed from depths of 200 fsw. Equilibration of critical tissues was complete in 60-90 min. Salmonids and air-breathers are sensitive to decompressions at similar levels of supersaturation if elimination of excess gas following decompression is unrestricted. However, if elimination is restricted, bubble formation and growth increase accordingly. Tests with mixtures of He-O₂, Ar-O₂, N₂-O₂ (80% inert gas; 20% O₂) and pure oxygen demonstrated that gas solubility as well as supersaturation (P), pressure ratio (initial pressure: final pressure), and absolute pressure must be considered in setting tolerance limits for any decompression. Gases with higher solubility are more likely to produce bubbles upon decompression. Oxygen, however, does not follow this relationship until higher pressures are reached, probably owing to its function in metabolism and in binding with hemoglobin. Tissue responses observed in both GBD and decompressed fish involved similar pathological effects at acute exposures. The circulatory system was consistently affected by bubbles that occluded vessels and blocked flow through the heart. (Katz)
W77-07706

EFFECTS OF AIR-SUPERSATURATED WATER ON SURVIVAL OF PACIFIC AND STEELHEAD SMOLTS, Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
A. V. Nebeker, and J. R. Brett.
Transactions of the American Fisheries Society, Vol. 105(2), p. 338-342, 1976. 3 tab., 6 fig., 13 ref.

Descriptors: *Fish disease, *Anadromous fish, Juvenile fish, *Fish physiology, Pathology, *Supersaturation, *Sockeye salmon, Rainbow trout, Laboratory tests, *Columbia River, Bioassay, Mortality.
Identifiers: *Coho salmon, *Gas bubble disease, *Steelhead trout, *Emphysema, Steelhead smolts, Salmon smolts, *Subcutaneous emphysema, *Exophthalmia.

Coho (Oncorhynchus kisutch) and sockeye (O. nerka) salmon smolts and steelhead trout (Salmo gairdneri) smolts were exposed to several concentrations of air-supersaturated water in the laboratory from March through June, 1974, the normal fish migration period in the Columbia River and the time when the river water is usually supersaturated. Tests were conducted at 12°C in water 60 cm deep. Time to 20 percent death was determined and lethal threshold concentrations of 114.5 percent saturation for coho, 113.5 percent for sockeye, and 114.0 percent for steelhead were calculated. Ninety-six hour LC50 values were 120.5 percent for coho, 116.7 percent for sockeye, and 116.0 percent total gas percent saturation for steelhead. Thirty-day LC50 values were 116.2 percent for coho, 113.9 percent for sockeye, and 114.0 percent for steelhead. Severe emphysema (bubbles) occurred on fins, in the mouth, and on the head and opercles of the fish exposed to 120 percent and 115 percent saturation. Emphysema was not as severe at 110 percent but occurred in 60 percent of the coho, 20 percent of the sockeye, and 80 percent of the steelhead. (Katz)

W77-07707

EFFECTS OF GAS SUPERSATURATED COLUMBIA RIVER WATER ON THE SURVIVAL OF JUVENILE CHINOOK AND COHO SALMON,

National Marine Fisheries Service, Seattle, Wash. T. H. Blahm, R. J. McConnell, and G. R. Snyder. NOAA Technical Report NMFS SSRF-688, April, 1975, 22 p, 5 tab., 8 fig., 9 ref., 4 append.

Descriptors: *Supersaturation, *Chinook salmon, *Columbia River, Water pollution effects, *Nitrogen, Gases, Juvenile fish, Fish behavior, Fish physiology, Methodology, Bioassays, Aquaria, Laboratory equipment, *Hydrostatic pressure, Rainbow trout, Mortalities. Identifiers: Coho salmon, Steelhead trout, *Gas bubble disease, Water depth, Depth distribution.

The deleterious effect of high concentrations of dissolved gas on valuable stocks of Columbia River salmon and trout has led pollution control agencies in the Pacific Northwest to consider establishing standards for the amount of dissolved gas in the water. Research has been done with salmonids to define the criteria upon which such standards should be based, but the majority of these studies were carried out in shallow tanks (less than 1 m deep) where supersaturated concentrations of gas had been artificially induced. This report discusses tests that were performed at a field laboratory on the Columbia River. Juvenile chinook *Oncorhynchus tshawytscha*, and coho, *O. kisutch*, salmon were tested in deep and shallow tanks with river water reflecting the prevailing (and fluctuating) concentrations of dissolved gases. Results indicated that the water depth in a deep (3 m) test tank enhanced the survival of test fish compared to shallow tanks (< 1 m). These tests support the hypothesis that test conditions in tanks 1 m deep are not representative of all river conditions that directly relate to mortality of juvenile salmon and trout in the Columbia River. (Katz)

W77-07708

HYDROCHEMICAL OBSERVATION OF THE GROUND WATER FOR TROUT CULTURE AROUND HINO-TOWN, TOKYO, (IN JAPANESE),

Y. Satomi. Bulletin of Fresh-Water Fisheries Research, Laboratory Tokyo, Japan, Vol. 5, No. 1, 1955, p. 31-38, 4 tab., 3 fig., 22 ref.

Descriptors: *Trout, *Aquaculture, Water quality, *Hydrogen ion concentration, *Water temperature, Fish establishment, Fish farming, *Oxygen, *Fish hatchery, Gases, Nitrogen, Fish disease, *Carbon dioxide, *Alkalinity, Groundwater, *Supersaturation, *Springs. Identifiers: Hino-Town, Tokyo, *Japan, *Nitrogen supersaturation.

In any of the waters tested the pH value and temperature were found to be normal, not unsuitable to fish raising. The dissolved nitrogen gas content, found to surpass 120% in most waters, is believed harmful to trout especially in the fry stage, but the percentage is lowered to 120% level when the water was fed to fish pond from the source exposing to air. The probable ill effect of supersaturated nitrogen gas (to gas disease) is not feared in this district because the trout farms here, due to the high water temperature, do not handle the trout fry. Oxygen content was sufficient if the water is aerated; carbon dioxide content was also bearable when the water is exposed to air. Alkalinity was higher with the depth of wells, and it was suggested that the deeper the well the better the water for the growth of fish. (Katz)

W77-07709

SNAKE RIVER, 1973 DISSOLVED GAS STUDIES.

Parametrix, Inc., Seattle, Wash. For primary bibliographic entry see Field 5A. W77-07710

DIE KUNSTLICHE AUZUCHT VON CLUPEA HARENGUS L., (THE ARTIFICIAL PROPAGATION OF CLUPEA HARENGUS L.),

Biologische Anstalt Helgoland (West Germany). H. Schach. Helgoländischen Wissenschaftliche Meeresuntersuchungen, (German) Vol. 1(3), 1939, p. 359-372, 1 tab., 3 fig., 22 ref.

Descriptors: *Marine fish, *Aquaculture, *Fish hatchery, *Bubbles, *Fish diseases, *Mortalities, Aquaria, Fish behavior, *Juvenile fish, *Gases, On-site investigation, Fish physiology, Fish behavior, Commercial fish, *Herring. Identifiers: *Marine aquaculture, *Artificial propagation, *Gas bubble disease, Clupea harengus.

The likely cause of the gas bubbles in the gut of young herring larvae that result in mass mortalities is discussed. It is believed that the young fish snapped at and swallowed the fine air bubbles in the aquarium waters and were not able to discharge them back into the water. (Katz)

W77-07711

MECHANISM OF GASEOUS EXOPHTHALMIA IN THE ATLANTIC COD, GADUS MORHUA L.,

Fisheries and Marine Service, St. Andrews (New Brunswick), Biological Station. P. V. Dehadrai. Journal of the Fisheries Research Board of Canada, Vol. 23(6), 1966, p. 909-914, 5 fig., 13 ref.

Descriptors: *Marine fish, Commercial fish, *Fish diseases, *Fish physiology, *Biochemistry, *Bubbles, *Aquaria, *Saturation, On-site investigation, Laboratory tests, Aquaculture. Identifiers: *Gaseous exophthalmia, *Cod, Gadus morhua, *Gas bubbles, Gas secreting mechanism, Eye of cod, *Gas secretion, Choroid gland, Blood capillaries.

Gadus morhua L. in captivity often develop unilateral or bilateral exophthalmia, characterized by the accumulation of gas bubbles in the eye. Rete mirabile-like organization of capillaries in the choroid 'gland' in association with the glandular pseudobranch, which is a rich source of carbonic anhydrase in fishes, are involved in gas secretion in the eye of cod. Intraperitoneal injections of Diamox and pseudobranchectomy prevented exophthalmia in the fish. Presence of glycogen and carbonic anhydrase in the choroid gland in relation to gas secretion in the eye suggests a parallel with the process of gas secretion in the teleostean swimbladder. Gas secretion in the eye of cod resulting in exophthalmia would seem to be a malfunctioning of the choroid gland-pseudobranch complex in the fish triggered by unknown stimuli. (Katz)

W77-07712

PASSING FISH THROUGH HYDRAULIC TURBINES,

Army Engineer District, Walla Walla, Wash. For primary bibliographic entry see Field 8I. W77-07713

SOME EXPERIMENTS ON THE GAS-DISEASE IN FRESHWATER FISHES, (IN JAPANESE),

S. Egusa. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 15(1), 1948, p. 83-87, 5 tab., 1 fig., 15 ref.

Descriptors: *Fish disease, Freshwater fish, *Supersaturation, *Wells, *Nitrogen, *Artesian

wells, Water quality, Fish physiology, *Water supply, Carp, Eels, Oxygen, Water temperature, *Laboratory tests. Identifiers: *Gas bubble disease, *Goldfish, *Japan.

Some experiments as regards the so-called gas-disease were made with use of artesian well-water which contained nitrogen in various supersaturated conditions upon five fresh water species of fish. Effects of degree of supersaturation upon the viability, etc., were examined. Results of the experiments are shown. Further, it was shown that conditions of physiological and environmental factors seriously affected the progress of the disease. (Katz)

W77-07714

WATER QUALITY REQUIREMENTS OF FISHES AND EFFECTS OF TOXIC SUBSTANCES,

Oregon State Univ., Corvallis. Dept. of Fish and Game Management. P. Doudoroff. In: The Physiology of Fishes, M.E. Brown, ed. Volume II, Behavior, Academic Press, Inc., New York, 1957, p. 415-417.

Descriptors: *Oxygen, *Nitrogen, Gases, *Fish disease, *Supersaturation, *Fish physiology, Mortalities, Freshwater fish, *Water quality, *Reviews, Water pollution effects. Identifiers: *Oxygen-nitrogen value, *Gas bubble disease.

Two to three times the normal air-saturation values of dissolved oxygen do not affect freshwater fish. Supersaturation of water with atmospheric gases (nitrogen and oxygen) can cause fatal gas bubble disease when the total pressure of the dissolved gases greatly exceeds the hydrostatic pressure. Body fluids of fish held in supersaturated water soon become supersaturated with atmospheric gas. The bubbling of pure nitrogen or oxygen through water cannot cause gas bubble disease. (Katz)

W77-07715

THE GAS BUBBLE DISEASE OF FISH, (DIE GASBLASEN KRANKHEIT BEI FISCHEN),

O. L. Engelhorn. Zeitschrift für Fischerei, Vol. 41(3), December 1943, p. 297-317, 1 fig., 34 ref.

Descriptors: *Fish diseases, *Fish physiology, Aquaculture, *Freshwater fish, Animal pathology, Water quality, *Phytoplankton, *Physiological ecology, *Mortalities, Laboratory tests, Gases, Oxygen, Nitrogen. Identifiers: *Gas bubble disease, *Gas emboli, *Exophthalmia, Fish ponds.

The gas bubble disease in fish is due to the difference in gas tension of the surrounding water and the body of the fish. In nature abnormally high gas tensions are developed by the activities of the green phytoplankton. Gas bubble disease proceeds to mortalities when the emboli occlude the blood vessels. In trout hatcheries, rapid water exchange is recommended while in large carp ponds treatment is difficult but the carp can escape by sounding into the deeper waters. Analyses were made of the gas content of gas bubbles in the eyes and heart of affected fish. (Katz)

W77-07716

EIN FORELLEN BRUTSTERBEN UNTER EIGENARTIGEN BEGLEITERSCHINUNGEN (A MORTALITY OF TROUT FRY CAUSED BY UNUSUAL CIRCUMSTANCES),

Bayerische Biologische Versuchsanstalt, Munich (West Germany). L. Scheuring, and O. Heuschmann. Zeitschrift für Fischerei, Vol. 33(4), 1935, p. 707-716, 5 fig.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Trout, *Juvenile fish, *Fish disease, Fish physiology, *Aquaculture, *Mortality, Saturation, *Supersaturation, Fish hatcheries, *On-Site investigations.
Identifiers: *Yolk sac fry, *Gas emboli, *Deformities, Gas bubble disease.

A mortality of trout fry is described. The disease is characterized by a gas bubble in the mouth which suspends the fish in a vertical position. Most of the fish were observed to have a peculiar deformity on the hyoid area of the mouth which creates the fatal gas bubble. Water quality was within normal limits. Other workers (Engelhorn) believe these fish exhibit signs of gas bubble disease and the deformity is due to the gas embolism. (Katz)
W77-07717

DISSOLVED GAS SUPERSATURATION IN THE SALMON RIVER, 1972-74,
Parametrix, Inc., Bellevue, Wash. Environmental Services Section.
For primary bibliographic entry see Field 5A.
W77-07719

AN ANALYSIS OF THE FEASIBILITY OF USING AIR AGITATION TO REDUCE GAS SATURATIONS IN SEA WATER AT PILGRIM NUCLEAR POWER STATION,
Yankee Atomic Electric Co., Westborough Mass. Environmental Sciences Group.
For primary bibliographic entry see Field 5G.
W77-07720

GAS-BUBBLE DISEASE: A REVIEW IN RELATION TO MODERN ENERGY PRODUCTION,
Rhode Island Univ., Kingston. Marine Pathology Lab.
R. E. Wolke, G. R. Bouck, and R. K. Stroud.
In: Fish and Energy Production: A Symposium, 1974, S. B. Saila, Editor, Heath Co., Mass, p. 240-265, 64 ref.

Descriptors: Fish disease, *Fish physiology, Pathology, *Reviews, *Supersaturation, *Power plants, *On-Site investigations, *Aquaria, *Hydroelectric power, Water temperature, *Nuclear power plants, Gases, *Solubility, Pollutant identification, Measurement.
Identifiers: *Gas emboli, *Pathological process, *Gas bubble disease, Exophthalmia.

The literature is reviewed and gas-bubble disease (GBD) is considered in light of recent findings. The process is defined and the environmental parameters necessary for its development examined. The role of power plants in its pathogenesis is also considered. Special emphasis is placed on the description of gross and histopathological lesions as well as newer methods for field diagnosis employing gross lesions and rapid techniques for the in situ measurement of dissolved gas total pressure. (Katz)
W77-07721

DISSOLVED GAS SUPERSATURATION, GRAND COULEE DAM PROJECT, 1973,
Seattle Marine Labs., Seattle, Wash.
For primary bibliographic entry see Field 5B.
W77-07722

MOBILE FISH CAGE AND DEPTH DISTRIBUTION STUDIES, COLUMBIA AND SNAKE RIVERS,
Seattle Marine Labs., Seattle, Wash.
Prepared for Utility Cooperative, c/o Idaho Power Co., Boise, Idaho, February, 1974. 39 p, 7 tab., 7 fig., 4 ref.

Descriptors: *Columbia River, *On-Site investigations, *Water quality, Chinook salmon, Rainbow trout, *Nitrogen, Gases, *Mortalities, *Bioassay, Fish Behavior, *Fish migration, Anadromous fish, Fishing gear, Distribution.

Identifiers: *Depth distribution, *Columbia-Snake Confluence, Gill nets, *Fish cages.

A mobile fish cage was developed to study mortalities of downstream migrant juvenile salmonids in the Columbia River during the periods of dissolved gas supersaturation. Mortalities were the same in all of the various compartments. Dissolved nitrogen content of the river did not get above 111% saturation. A second study to determine the distribution of migrating salmonids showed that most fish captured were in the upper three meters which is the critical zone. (Katz)
W77-07723

PRELIMINARY STUDIES OF MENHADEN AND THEIR MASS MORTALITIES IN LONG ISLAND AND NEW JERSEY WATERS,
New Jersey Agricultural Experiment Station, New Brunswick.
J. R. Westman, and R. F. Nigrelli.
New York Fish and Game Journal, Vol. 2(2), July, 1955, p. 142-153, 3 tab., 7 fig., 9 ref.

Descriptors: *Commercial fish, Marine fisheries, *Mortality, *Fish diseases, *Animal pathology, New York, Fish behavior, Parasitism, On-Site investigation, Fish, Growth, New Jersey.
Identifiers: *Menhaden, *Gas emboli, *Annual mortality, *New York Bight, Exophthalmia, *New York harbor.

An annual, heavy mortality of menhaden in the waters adjacent to New York Harbor occurs in late May and June when millions of fish die and litter the beaches. Dying fish, called 'Spinners' are characterized by a loss of coordinated movements and exophthalmia of one or both eyes. Hemorrhages caused by gas emboli were noted in the capillaries of the gills, eyes, and optic lobes of the brain. Menhaden along the Atlantic coast of North America are susceptible to a variety of parasites, which, especially those found on the gills, may contribute to the mass mortalities observed. (Katz)
W77-07724

NOTES ON THE EXPOSURE OF SEVERAL SPECIES OF FISH TO SUDDEN CHANGES IN THE HYDROGEN ION CONCENTRATION OF THE WATER AND TO AN ATMOSPHERE OF PURE OXYGEN,
Bureau of Fisheries Lab., Fairport, Iowa.
A. H. Wiebe.
Transactions of the American Fisheries Society, Vol 61, 1931, p 216-224. 1 tab.

Descriptors: *Bioassays, *Hydrogen ion concentration, *Oxygen, *Supersaturation, Laboratory tests, Water quality, Freshwater fish, Warmwater fish, *Bass, *Sunfishes, Juvenile fish, *Fish disease, *Hydrostatic pressure.
Identifiers: Bluegill sunfish.

Several species of fish have been subjected to higher concentrations of dissolved oxygen when an atmosphere of pure oxygen was maintained over the surface of the water and also with a super-stratum of pure oxygen under pressure. Several species of fish have been subjected to sudden transfers from low O₂ to high O₂ and the reverse (5.6 ppm to 40.33 ppm and from 41.0 ppm to 7.3 ppm). The results show (a) that different sizes of several species of fish tolerate large and sudden changes in the concentration of O₂ in either direction, (b) that these fish can live in water containing a large excess of dissolved oxygen with a super-stratum of pure oxygen over the surface, (c) that several species of fish can stand pressure of 10 to 13 lbs for a period of 24 hours and pressures from 15 to 19 lbs for shorter periods. (Longer periods not investigated.) The increase in dissolved oxygen is followed by a slowing down of the respiratory movements. No instances of exophthalmus, opaqueness of the lens, and of the accumulation of gas bubbles were observed. No fish were observed to lose their equilibrium except in

the pressure experiment where depression occurred too rapidly. (Katz)
W77-07725

GAS DISEASE IN FISHES - A REVIEW,
Toronto Univ. (Ontario). Dept. of Zoology.
H. H. Harvey.
In: Chemistry and Physics of Aqueous Gas Solutions, The Electrochemical Society in Princeton, New Jersey, 1975. p 450-485, 126 ref.

Descriptors: *Fish diseases, *Fish physiology, Pathology, *Gases, *Solubility, Equilibrium, *Supersaturation, Freshwater fishes, Nitrogen, Oxygen, Argon, Rainbow trout, Wells, Springs, *Water temperature, Hydroelectric power, Dams, *Reviews, *Bibliographies.

Gases dissolve in water as a function of partial pressures and solubilities. In lakes and streams, air-equilibration occurs only at the water surface. Conditions such as heating at depth by insolation, and entrainment of air and its solution under pressure at the bases of falls, result in gaseous supersaturation. Under these conditions the body fluids of fishes may become supersaturated, resulting in gas-bubble formation in tissues and blood vessels of fish. This may be chronic at low, or rapidly lethal at high, levels of supersaturation. (Katz)
W77-07727

EXPERIMENTAL STUDY OF ACUTE TOXICITY OF SALTS OF COBALT, ANTIMONY, STRONTIUM AND SILVER CRUSTACEANS AND THEIR LARVAE AND IN SOME TELEOSTS, (IN FRENCH),
CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les Durance (France). Departement de Protection; and CEA Centre d'Etudes Nucleaires de Cadarache, Saint-Paul-les Durance (France). Laboratoire de Radioecologie Continentale.
J. C. Amiard.
Rev Int Oceanogr Med 43, p 79-95, 1976.

Descriptors: *Toxicity, Salts, Cobalt, *Metals, Antimony, Strontium, *Teleosts, Crustaceans, Water pollution effects, Larvae.
Identifiers: Blennius-pholis, Carcinus-maenas, Maja-squinado, Palaemon-serratus, pleuronectes-platessa, Silver.

Among the 4 salts of metals or metalloids studied, Ag is the most toxic relative to all species used, followed by Sb, Co and Sr. Some correlations are established between the degree of toxicity and certain physico-chemical properties of ions. The crustacean (Carcinus maenas, Palaemon serratus) and teleost (Pleuronectes platessa, Blennius pholis) adult specimens present almost identical sensitivities relative to all pollutants. Crustacean larvae (C. maenas, P. serratus, Homarus vulgaris, Maja squinado) are much more sensitive than the adults to pollutant action. Among the larvae, the smallest react to the weakest concentrations. Acute toxicity tests are insufficient and should be complemented by sublethal tests using alterations of the fundamental physiological functions.—Copyright 1977, Biological Abstracts, Inc.
W77-07728

SUMMARY OF GAS SUPERSATURATION RESEARCH AT WESTERN FISH TOXICOLOGY STATION (EPA), CORVALLIS, OREGON, 1972-1974.
Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
1974, 22 p.

Descriptors: *Supersaturation, *Fish diseases, *Salmon, Rainbow trout, Pathology, *Fish physiology, *Oxygen, *Carbon dioxide, Juvenile fish, Fish behavior, Water quality, *Chinook salmon, *Methodology, Laboratory equipment, Laboratory tests, Sockeye salmon, Invertebrates, Benthos, Freshwater fish.
Identifiers: *Gas bubble disease, *Steelhead trout.

Abstracts of 13 studies carried out at the EPA laboratory in Corvallis, Oregon, regarding the biological effects of gas supersaturation on salmonids are given. These studies include methodology, pathology of fish exposed to supersaturated water, the acute lethality of supersaturation to salmonids, oxygen and carbon dioxide as factors affecting fish survival in gas supersaturated waters, lethal and sublethal effects of gas-supersaturated water in aquatic invertebrates and effect of depth compensation on toxicity of gas supersaturated water to juvenile steelhead trout. (Katz)
W77-07729

COMPARATIVE STUDY OF CLADOCERA FROM THE 1ST METER OF SEA WATER, COLLECTED IN A POLLUTED ZONE AND IN ANOTHER RELATIVELY CLEAN ZONE, (IN FRENCH), Athens Univ. (Greece). Zoological Lab. and Museum.
M. Moraitou-Apostolopoulou, and V. Kiortsis.
Rev Int Oceanogr Med 43, p 37-46, 1976.

Descriptors: *Crustaceans, Water pollution, Sea water, Distribution, Sewage disposal, Seasonal, Coasts, Marine animals.
Identifiers: Evadne-normani, Evadne-spinifera, Evadne-tergestina, Greece, Penilia-avirostris, Podon-intermedius, Podon-polyhemoides, *Saronicos Gulf (Greece).

A comparative study of the most superficial (0-100 cm layer) cladocerans was made, to assess the influence of marine pollution on their occurrence and distribution. Two collecting stations were established in the coastal waters of Saronikos gulf, near Athens (Greece). One was in a polluted area near the main sewage outfall, the other in an area of purer waters. Statistically significant differences in water temperature and in the occurrence and abundance of various cladoceran species were observed between the 2 stations. In addition to their usual vertical microdistribution and seasonal variation, a preference of some of the species (*Evadne spinifera*) for clear vs. polluted water (*E. tergestina* and *Podon polyphemoides*) was noted. The ecological characteristics of the 6 spp. examined were analyzed in comparison with recently published data on this group. (The other 3 spp. are *E. nordmani*, *P. intermedius* and *Penilia avirostris*).—Copyright 1977, Biological Abstracts, Inc.
W77-07730

OIL SPILL AT DECEPTION BAY, HUDSON STRAIT, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 5G.
W77-07731

ENZYME KINETICS—A REVIEW WITH EMPHASIS ON INHIBITION OF ENZYMES, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 5B.
W77-07732

VERTICAL MIXING MECHANISMS AND THEIR EFFECTS ON PRIMARY PRODUCTION OF PHYTOPLANKTON, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
P. G. Harris.
Canada Center for Inland Water Scientific Series No. 33, 1973, 17 p., 16 fig., 32 ref., 3 tab.

Descriptors: *Phytoplankton, *Hysteresis, *Photosynthesis, Chlorophyll, Turbidity, Lake Ontario, Waves (Water), Wind velocity, Mixing, *Primary productivity, Cytological studies, Water pollution effects, Lakes, Canada, Sampling.

Identifiers: Lake surfaces, Wave damping, Downwelling, Energy exchanges.

The significance or otherwise of this hysteresis effect in the field, was examined. In operation in the field any method of moving cells vertically in the water column might lead to hysteresis effects. The study looked for evidence that Lenzmuir cells existed and that streaking was associated with roll vortices in the surface water layers. In Lake Ontario, surface streaking occurs at wind speeds in excess of 3.5 m/sec. There is a downwelling of water beneath the streak, the velocity of which is correlated with the wind speed over the surface. Observations of the sinking metal drogue indicated not only a vertical component to the downwelling but also a lateral motion away from the streak at depths of a few metres. Chlorophyll measurements have shown that mixing occurs at wind speeds in excess of 3.5 - 4.0 m/sec. and that the mixing effect can on occasion be detected at 5 m despite river plume interference. The photosynthesis data showed that in July the hysteresis effect was small and that its contribution to production estimates was unlikely to be significant in the Langmuir circulations. However the effect of vertical motions at other times of the year could be highly significant due to large hysteresis effects and deep mixing. Mixing has been shown to be important in July in that it ensured that the cells were exposed to high light at the surface for brief periods only. Long exposure to light (even as low as 40% full sun) were shown to lead to a steady decrease in the rate of photosynthesis. Considering that vertical mixing was demonstrated on all occasions when the wind speed exceed 3.5-4.0 m/sec. and considering that 14C bottles appear to reproduce only static water production profiles, then the use of 14C bottles must be questioned. (WATDOC)
W77-07733

THE STUDY OF THE BENTHOS COMMUNITY AROUND THE MOUTH OF THE PORT OF TAGONOURA IN SURUGA BAY, (IN JAPANESE), M. Kosaka, M. Ogura, T. Akaogi, and K. Mori.
J. Fac. Mar. Sci. Technol. Tokai Univ 9, p 53-64, 1976.

Descriptors: *Benthos, *Bays, *Bottom sediments, Waste disposal, Harbors, Asia, *Biomass, Mollusks, Water pollution, *Organic wastes, *Pulp wastes, Annelids, Arthropoda, *Industrial wastes.
Identifiers: Capitella-Capitata-Japonica, Japan, Stauroisereis-Caecus, Suruga, Tagonoura, *Port of Tagonoura (Japan).

On Feb. 25, 1971, a benthos survey was carried out with the Smith-McIntyre sampler (1/10 m²) at 20 stations on the bottom around the mouth of the Port of Tagonoura (Japan) where the water and bottom sediments were polluted by the discharge of waste products from the pulp industry. The relations between the benthos community structure and pollution, and between the composition of taxonomic groups and pollution were studied. The ignition loss in bottom mud was <10%, except in front of the port. No azoic area was found in the area surveyed. Mean biomass of total macrobenthos was 26.4 g/m². Mean biomass and the biomass percentage of each taxonomic group were Annelida 14.8 g/m², 55.9%; Mollusca 5.6 g/m², 21.2%; Arthropoda 6.0 g/m², 22.7%. The indicator species of organic pollution, e.g., *Capitella capitata japonica* and *Stauroisereis caecus* (Polychaeta) almost covered the central part of the survey area. Conditions of organic pollution in the survey area were almost the same or better than in 1958.—Copyright 1977, Biological Abstracts, Inc.
W77-07735

EFFECT OF SOUTH LOUISIANA CRUDE OIL AND NO. 2 FUEL OIL ON GROWTH OF HETEROTROPHIC MICROORGANISMS, IN-

CLUDING PROTEOLYTIC, LIPOLYTIC, CHITINOLYTIC AND CELLULOYTIC BACTERIA, Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, P. A. Seesman, and R. R. Colwell.
Available from the National Technical Information Service, Springfield VA 22161 as ADA016 327
Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: Environmental Pollution, Vol 9, p 13-33, 1975. 16 fig., 2 tab., 47 ref. ONR-N00014-67-A-0239-0027.

Descriptors: *Chesapeake Bay, *Oil pollution, *Microorganisms, *Bacteria, Toxicity, Fossil fuels, Water pollution effects, Estuaries, Nutrients, *Oil wastes, Bays.
Identifiers: *Crude oil, Fuel oil.

Muddy Creek, a sub-estuary of the Rhode River in Chesapeake Bay, was examined to determine the susceptibility of the autochthonous microorganisms to South Louisiana crude oil and No. 2 fuel oil. Muddy Creek sediment was found to be free of contaminating oil. Crude and fuel oil induced little noticeable effect on the yeast and fungi populations, whereas the crude oil was found to support growth of bacteria and the fuel oil to limit such bacterial growth. Normalising the values with reference to the control cultures revealed that both the crude and fuel oils were toxic for the bacteria. The crude oil showed greater toxicity. (Sinha-OEIS)
W77-07736

DEGRADATION OF PETROLEUM BY AN ALGA, PROTOTHECA ZOPFII, Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, R. R. Colwell, and L. Petrakis.
Available from the National Technical Information Service, Springfield VA 22161 as AD-A016 326, Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: Applied Microbiology, Vol 30, No 1, p 79-81, July 1975. 3 tab., 7 ref. ONR-N00014-67-0237-0027.

Descriptors: *Algae, *Oil pollution, *Biodegradation, Bacteria, Water pollution, Organic compounds, *Oil wastes.
Identifiers: *Prototheca zopfii.

Prototheca zopfii is an achlorophyllous alga which degrades oil. It has been found to degrade 10 and 40% of a motor oil and crude oil, respectively, when tested under appropriate conditions. Degradation of the crude oil observed in this study compares well with the amount of degradation accomplished by bacteria. *P. zopfii* was found to degrade a greater percentage of the aromatic hydrocarbons in motor oil than of the saturated hydrocarbons and a greater percentage of saturated hydrocarbons in crude oil than of aromatic hydrocarbons. Resins and asphaltenes were produced during degradation of motor oil, whereas these fractions in crude oil were degraded. *P. zopfii* did not demonstrate preferential utilization of lower homologues of cycloalkanes and aromatics as has been observed bacteria. (Sinha-OEIS)
W77-07737

CHARACTERISTICS OF THE AREAS IN WHICH FAST CURRENT OIL CONTROL IS NEEDED, Coast Guard, Washington, D.C. Pollution Prevention Projects Branch.
For primary bibliographic entry see Field 5G.
W77-07741

THE INVERTEBRATE FAUNA OF THE BROEL AND ITS TRIBUTARY BROOKS, (IN GERMAN), B. Roesser.
Decheniana 129, p 107-130, 1976.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

Descriptors: *Invertebrates, Water quality, Water pollution, Streams, Systematics.
Identifiers: Ephemeroptera, Plecoptera, Trichoptera, *West Germany.

The brooks Broel, Waldbroel and 17 tributaries were investigated in autumn 1973 and in early spring 1974 with special regard to the macroinvertebrates. The fauna of 9 springs was also examined in the winter of 1973-1974. The area of investigation is located in SW Suederbergland (West Germany, Nordrhein-Westfalen). Nearly 30,000 organisms (114 spp. or higher taxa) were collected, predominantly Ephemeroptera, Plecoptera and Trichoptera. The water quality was evaluated on the basis of the invertebrate fauna.—Copyright 1977, Biological Abstracts, Inc. W77-07746

UTILIZATION OF MIXED HYDROCARBON SUBSTRATE BY PETROLEUM-DEGRADING MICROORGANISMS.
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, H. F. Austin, and R. R. Colwell.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A016 324. Price codes: A02 in paper copy, A01 in microfiche. Reprinted from: *Journal of General and Applied Microbiology*, Vol 21, p 27-39, 1975. 3 fig, 8 tab, 12 ref. ONR-N00014-67-A-0239-0027.

Descriptors: *Chesapeake Bay, *Biodegradation, *Oil pollution, *Microorganisms, Water pollution, *Yeasts, *Fungi, *Bacteria, Organic compounds, Bays.

The first comparative study of petroleum-degrading yeasts, fungi, and bacteria, and their ability to degrade a mixed hydrocarbon substrate is described. The mixed hydrocarbon substrate employed contained aliphatic, alicyclic, aromatic, and polynuclear aromatic hydrocarbons. Most of the bacteria and all of the yeasts and fungi were isolated from Chesapeake Bay. Normal alkanes were found to be less susceptible to degradation by bacteria and yeasts as the carbon chain length of the hydrocarbon increased from 10 to 20. Results obtained for some of the fungi showed that there was little correlation between chain length of normal alkane and susceptibility to biodegradation. Cumene, naphthalene, phenanthrene, pristane, 1,2-benzanthracene, perylene, and pyrene were found to be degraded by microorganisms. The patterns observed for hydrocarbon utilization were similar for the bacteria, yeasts, and fungi. However, the utilization of hydrocarbons by individual isolates varied significantly. (Sinha-OEIS) W77-07749

IMPACTS OF OFFSHORE OIL ON NORTH EAST SCOTLAND.
Massachusetts Inst. of Tech. Cambridge.
J. Hutton.
Available from the National Technical Information Service, Springfield, VA 22161 as COM-75-11026. Price codes: A03 in paper copy, A01 in microfiche. Report No. MITSG 75-15, Index No. 75-915-Wdm, June 1, 1975. From a lecture presented by the MIT Sea Grant Program on 28 April 1975, by John Hutton, North East Scotland Development Authority. 33 p, 1 fig.

Descriptors: *Oil spills, *Oil pollution, *Water pollution effects, *Resources development, *Environmental effects.
Identifiers: Outer Continental Shelf, *Scotland, *Environmental impact.

Exploration for and production of oil and natural gas from the North Sea has already had an important impact on economic and social life in North East Scotland. The industry's potential for the economy of both the United Kingdom and the region is considerable. The paper outlines the role of

the regional development and promotion agency, the North East Scotland Development Authority (NESDA), in offshore oil, and examines some of the benefits and problems generated by this new industry for the region which includes the City of Aberdeen and the Counties of Aberdeen, Banff, Kincardine, Moray, and Nairn. (Sinha-OEIS) W77-07752

PRELIMINARY PROJECTIONS OF OIL SPILL MOVEMENT FOR THREE POTENTIAL DEEP-WATER PORT SITES IN THE GULF OF MEXICO.
Coast Guard Research and Development Center, Groton, Conn.
For primary bibliographic entry see Field 5B. W77-07753

HETEROTROPHIC NITRIFICATION IN SOILS AND AQUATIC ENVIRONMENTS, (IN RUSSIAN).
V. Verstrete.
Izv Akad Nauk SSR Ser Biol 4, p 541-558, 1975.

Descriptors: *Nitrification, *Soils, Microorganisms, *Aquatic fungi, *Bacteria, *Nitrogen compounds, Nitrates, Nitrites, Oxidation.
Identifiers: *Actinomycetes, *Heterotrophic microorganisms.

Until recently it was thought that NH₃ oxidation to NO₃ and NO₂ could be caused only by chemoautotrophic microorganisms. Many heterotrophic microorganisms (fungi, bacteria, actinomycetes) are able to oxidize reduced N compounds (NH₃, amine N, oxime N, hydroxylamine etc). This is followed by the formation of NO₂, NO₃, hydroxylamine, hydroxam compounds, amino oxides etc. Heterotrophic nitrification takes place in laboratories and under natural conditions.—Copyright 1977, Biological Abstracts, Inc. W77-07754

BIOLOGICAL ASSESSMENT OF THE WATER QUALITY OF THE SMALL RIVERS SORA AND BYURYA (YENISEI BASIN), (IN RUSSIAN).
Moscow State Univ. (USSR). Dept. of Hydrobiology.
Z. G. Gol'd.
Biol Nauki (Moscow) 19 (3), p 40-45, 1976.

Descriptors: *Phytoplankton, *Zooplankton, *Benthos, Rivers, Water pollution, Industrial wastes, Domestic wastes, Farm wastes, *Self purification, Oligotrophy, Mesotrophy.
Identifiers: *Yenisei Basin (Siberia-USSR).

Possible changes in phyto- and zooplankton and benthos composition of the Rivers Sora and Byurya (Siberia, USSR) due to pollution with industrial, agricultural and domestic wastes were studied. Species diversity increased with distance from the area where wastewaters entered the rivers; the mass development of some species occurred in polluted sections. According to dominant indicator organisms, the upper reaches of the Sora and Byurya belong to the oligosaprobic zone, the wastewater discharge canal and middle section of the River Sora to the mesosaprobic zone, the mouth of the Sora to the a-B-mesosaprobic zone, and the middle section and mouth of the Byurya to the B-mesosaprobic zone. The self-purification processes in the River Byurya terminate with the B-mesosaprobic zone and the river does not return to the initial oligosaprobic condition.—Copyright 1977, Biological Abstracts, Inc. W77-07755

INVENTORY OF BENTHIC ORGANISMS AND PLANKTON AT MOKAPU, OAHU.
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2L. W77-07798

LIMNOLOGIC-GEOLOGIC EXCURSION IN THE TERRITORY OF THE LOWER ERFT RIVER, (IN GERMAN).
Landesanstalt fuer Gewaesserkunde und Gewässerschutz Nordrhein-Westfalen, Krefeld (West Germany).
For primary bibliographic entry see Field 5B. W77-07799

RESIDUES OF EMULSIFIED XYLENE IN AQUATIC WEED CONTROL AND THEIR IMPACT ON RAINBOW TROUT, SALMO GAIIRDNERI.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
For primary bibliographic entry see Field 5G. W77-07805

STUDIES OF THE BENTHIC ENVIRONMENT OF TWIN LAKES.
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
Report REC-ERC-76-42, October 1976, 47 p. Coordinated by James F. La Bounty.

Descriptors: *Benthic fauna, Diptera, Clams, *Bacteria, Anaerobic bacteria, Anaerobic conditions, E coli, Iron bacteria, Sulfate reducing bacteria, Deposition, Glacial deposits, Lacustrine deposits, *Sedimentation rates, Sampling, Pumped storage, Environment, Environmental effects, Heavy metals, Water pollution, *Limnology, Lakes, Reservoirs, Mud, Bibliographies, *Colorado.
Identifiers: Mt Elbert Pumped-Storage Plt(CO), *Twin Lakes(CO).

Three papers discuss ecological aspects of the benthic environment of Twin Lakes, Colo. The first paper discusses the general limnological aspects of Twin Lakes and specific biological aspects of their profundal benthic environment. The second paper includes sedimentation rates, sediment composition, and biological history of recent sediment of Twin Lakes. The third paper reports results of a study of coliform bacteria of the water and iron and sulfur bacteria of the bottom mud of Twin Lakes. This report covers one aspect of an overall study which is being made to evaluate what effects the operation of the Mt. Elbert Pumped-Storage Powerplant has on the ecology of a montane lake. Based on these studies, the lower lake was found to have a benthic fauna similar to other oligotrophic lakes of North America, while at times, the upper lake is nearly depopulated. Analyses of sediment indicate that since the turn of the century, heavy metals and nutrient input have significantly increased. (Bur Reclam) W77-07806

THE ARGO MERCHANT OIL SPILL. A PRELIMINARY SCIENTIFIC REPORT.
National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. NOAA Special Report, March 1977. 323 p, 18 ref. Peter L. Grose and James S. Mattson (eds.).

Descriptors: *Oil pollution, *Oil spills, *Water pollution effects, Weather, Environmental effects, Resources development, *Massachusetts, Atlantic Ocean.
Identifiers: Fuel oil, *Argo Merchant oil spill.

This report presents the available results from the investigations carried out to date by the many groups involved in the initial assessment of the distribution of the ARGO MERCHANT oil spill and its impact. For the many Federal, State, and private activities requiring information about the oil spill and its consequences the report is intended

to provide a unified summary of the studies that are being or have been carried out, the types and distribution of data, and such analyses and results as are now available. The outcome of the ARGO MERCHANT oil spill appears to have been fortunate in several respects: (1) the winds were almost continuously offshore, preventing the oil from coming on the beaches; (2) the density of the oil was low enough so that it did not sink and contaminate the bottom; and (3) the spill occurred in the winter, when biological activity, productivity, and fishing activities are relatively low. At another time, the effects of a similar oil spill might have been much more serious. (NOAA)

W77-07807

BENZENE SOURCES OF CONTAMINATION, AMBIENT LEVELS, AND FATE OF BENZENE IN THE ENVIRONMENT

Syracuse Univ. Research Corp., N.Y. Life Sciences Div.

For primary bibliographic entry see Field 5B.

W77-07819

EFFECTS OF POLLUTANTS ON EGGS, EMBRYOS AND LARVAE OF AMPHIBIAN SPECIES

California Univ., Irvine.

G. Greenhouse.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A025 403. Price codes: A03 in paper copy, A01 in microfiche. Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, Report AMRL-TR-76-31, April 1976. 24 p., 14 tab., 10 fig., 12 ref.

Descriptors: Bioassay, *Organic compounds, *Water pollution effects, *Frogs, *Amphibians, Toxicity, Embryonic growth stage, Methodology, Water pollution, *Toads.

Identifiers: *Leopard frog, *Rana pipiens*, *South African Claw Toad, *Xenopus laevis*, *Hydrazine, *Methylhydrazine, *Dimethylhydrazine, Phenyl-naphthylamine, Octyl-phenyl-naphthylamine, Diocetyl-diphenylamine, Teratology.

The effects of exposure to pollutants on the development of *Rana pipiens* and *Xenopus laevis* embryos and larvae are described. Compounds evaluated include N-phenyl-alpha-naphthylamine, octyl-phenyl-alpha-naphthylamine, diocetyl-diphenylamine, hydrazine sulfate, methylhydrazine, unsymmetrical dimethylhydrazine, and symmetrical dimethylhydrazine. Experiments focused on determination of lethal, teratogenic, and no effect levels of exposure. Techniques for exposing amphibian embryos and larvae to pollutants are also discussed. (Katz)

W77-07820

TOXICITY TO AQUATIC ORGANISM AND CHEMISTRY OF NINE SELECTED WATER-BORNE POLLUTANTS FROM MUNITIONS MANUFACTURE—A LITERATURE EVALUATION

Army Medical Bioengineering Research and Development Lab. Fort Detrick, Md.

D. Burrows, and J. C. Dacre.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A010 660. Price codes: A05 in paper copy, A01 in microfiche. Army Medical Research and Development Command, Washington, D.C. Report TR 7503, May 1975. 97 p., 19 tab., 1 fig., 315 ref., append.

Descriptors: *Toxicity, *Reviews, *Bibliographies, Animal populations, *Water quality, Water pollution effects, Aquatic animals, *Industrial wastes, Metals, Explosives, Lead, *Nitrogen compounds, Organic compounds, Potassium compounds, Phosphorus compounds, Strontium, Waste water pollution, Phytoplankton, Freshwater fish, *Phytotoxicity.

Identifiers: *Dinitrotoluene, Lead styphnate, *Munitions, Nitroguanidine, Pentaerythritol-tetranitrate, Picric acids, Potassium perchlorate, Red phosphorus, Strontium salts, Tetracene, Tetral, Trinitroresorcinol, *Literature review.

The literature regarding the toxicity to aquatic organisms and the related chemistry of nine military-relevant compounds was evaluated and reviewed. The selected compounds, munitions manufacturing products of potential concern as water-borne pollutants, are dinitrotoluene, tetral, and picric acid, trinitroguanidine, tetracene, potassium perchlorate, red phosphorus and strontium salts. Based on the available toxicity data, recommendations were made for further investigations to be conducted on the first seven of the listed compounds. No further toxicity studies have been proposed for red phosphorus and the strontium compounds. The required further work includes the determination of the 96-hour TLM using both native freshwater and marine test species; the conduct of complete chronic bioassay testing over the life-cycle of the same organisms used in the acute tests; the determination of the rates and products of microbial degradation, especially in the wastewaters; and complete wastewater analysis to estimate the concentrations of the pollutants and their photolysis and/or degradation products. (Katz)

W77-07821

RUM JUNGLE ENVIRONMENTAL STUDIES, SUMMARY REPORT

Australian Atomic Energy Commission Research Establishment, Lucas Heights.

For primary bibliographic entry see Field 5B.

W77-07822

MERCURY IN THE BIOGEOCHEMICAL ENVIRONMENT

Stanford Univ., Calif. Dept. of Applied Earth Sciences.

For primary bibliographic entry see Field 5B.

W77-07823

THE EFFECT OF ORGANOPHOSPHORUS INSECTICIDES ON NERVE AGENT DETECTOR TICKETS

Edgewood Arsenal, Aberdeen Proving Ground, Md.

A. Goodman, G. Smith, and R. M. Gamson.

Available from the National Technical Information Service, Springfield, VA 22161 as AD-A010 312. Price codes: A02 in paper copy, A01 in microfiche. Technical Report, ED-TR-75008, May 1975, 13 p., 3 tab., 10 ref.

Descriptors: *Pesticides, *Phosphorus compounds, *Phosphotriate pesticides, Enzymes, *Insecticides, Bioassay, Laboratory tests, Methodology, Analytical techniques, Solubility, Public health.

Identifiers: *Enzyme detection test, *Organophosphorus pesticides, *Response time, *Inhibition rates, Horse serum cholinesterase, Nerve agent detector tickets, *TEPP, *Naled, *Mevinphos, *Ethion, *Dioxathion, *Parathion, *Diazinon, *Demeton, *Meta-systox, *Trithion, *Trichlorofon, *EPN, *Guthion, *Malathion, *Methyl parathion, *Disulfation, *Imidan, *Dimethoate.

Experiments are described with a variety of commercial organophosphorus pesticides to determine their effects on the enzyme detection test used in the M15A2/M18A2 types of kits. Studies were made by direct application of the undiluted pesticide to the ticket to obtain an indication of the minimum quantity needed to inhibit the enzyme. Also, an investigation was made of aqueous solutions of the pesticides to obtain the same type of information. A wide range of response times was found indicative of different inhibition rates of horse serum cholinesterase by the different pesticides. (Katz)

W77-07824

EFFECTS OF MIREX AND METHOXYCHLOR ON STRIPED MULLET, MUGIL CEPHALUS L.

Oceanic Inst., Waimanalo, Hawaii.

J. H. Lee, C. E. Nash, and J. R. Sylvester.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-241 635. Price codes: A03 in paper copy, A01 in microfiche. Environmental Protection Agency, Ecological Research Series, Report EPA-660/3-75-015, May 1975, 18 p., 10 tab., 29 ref.

Descriptors: *Insecticides, Pesticides, *Chlorinated hydrocarbon pesticides, *Bioassay, Mortality, Laboratory tests, *Toxicity, Water pollution effects, Marine fish, Juvenile fish, *Mullet, Fish eggs, *Pesticide residues, *Path of pollutants. Identifiers: *Mirex, *Methoxychlor, Dynamic bioassay, *Striped mullet, *Mugil cephalus*, *Tissue concentration, *Tissue accumulation.

The effects of two chlorinated insecticides, mirex and methoxychlor, on striped mullet, *Mugil cephalus* L., were studied. Test concentrations of both insecticides used were 0.01, 0.1, 1.0 and 10.0 ppm in dynamic bioassay. Young juveniles were more susceptible to mirex exposure than older juveniles or adults. No mortalities occurred in older juveniles and adults exposed to mirex for 96 hours. For young juveniles, mortalities were highest in concentrations of 0.1 and 1.0 ppm and were less in concentrations of 0.01 and 10.0 ppm. Significant amounts of mirex residues were accumulated in the body tissues of the test fish; concentrations increased with increased environmental concentrations. Methoxychlor was more toxic to mullet than mirex. Mortalities were greater than 90 percent over a 96-hour period for all life stages studied at concentrations of 0.1, 1.0 and 10.0 ppm. Mortality at a concentration of 0.01 was 5.1 percent or less for 96 hours. Relative to mirex, small amounts of methoxychlor residues accumulated in the tissues of the test fish. Results of the experiments on eggs and larvae were inconclusive. Egg survival was slightly better in mirex than in methoxychlor over a 96-hour period. Larval survival was generally better in mirex than methoxychlor. (Katz)

W77-07825

INVESTIGATION OF ACID MINE DRAINAGE EFFECTS ON RESERVOIR FISHERY POPULATIONS

West Virginia Univ., Morgantown.

A. Benson.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-252 703. Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA-600/2-76-107, April 1976. 135 p., 35 tab., 13 fig., 17 ref.

Descriptors: *West Virginia, *Hydrogen ion concentration, Lakes, *Water quality, *Acid mine water, *Coal mine wastes, Coal mines, Limnology, Iced lakes, *Hydrology, Hydrologic cycle, Water temperature, Thermocline, Thermal stratification, *Chemical stratification, Water chemistry, *Freshwater fishes, Fish populations.

Identifiers: *Tygart Lake (WV), Transparency, *Sandy Creek (WV), Spring warming cycle, Autumn cooling cycle, Winter thermal minimum.

A limnological, water quality and quantity and lake fluctuation, transparency, and ice cover study was made of the Tygart Lake, West Virginia, and its tributaries. The watershed of this lake has been extensively mined for coal and acid mine drainage (AMD) is discharged throughout the area. The significant sources of AMD were found to be the Tygart River and Sandy Creek. Net changes in lake depth were 14-16 meters, and the maximum change was 22 meters. Transparency depth ranged from 0.1 m in December to 7.5 m in the summer. The major factors related to the development of acidity gradients in Tygart Lake were found to be

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

(1) hydrological characteristics including inflow, outflow, and the operational interaction between the inflow and outflow resulting in storage or drawdown, (2) thermal relationships including the spring warming cycle, thermal stratification during the summer, the autumnal cooling cycle, and the winter thermal minimum and (3) water chemistry including the existing chemical stratification or its lack at the beginning of a seasonal period and the chemical quality of inflow. (Katz)
W77-07827

EFFECT OF AIR POLLUTION ON PINUS STROBUS L. AND GENETIC RESISTANCE - A LITERATURE REVIEW,
Pennsylvania State Univ., University Park.
H. D. Gerhold.
Environmental Protection Agency, Ecological Research Series, Report EPA 600/3-77-002, January 1977. 36 p, 1 tab, 82 ref.

Descriptors: *Pine trees, *Conifers, Coniferous trees, *Coniferous forests, Air pollution, *Air pollution effects, Toxicity, *Phytotoxicity, Breeding, Ozone, Gases, *Reviews, Bioindicators, Monitoring.
Identifiers: *Eastern white pine, *Pinus strobus*, *Genetic resistance, *Literature reviews, *Phytotoxic gases, Plant gas emission, Air quality standards.

Effects of the main phytotoxic gases that injure eastern white pine (*Pinus strobus* L.) and the possibilities of breeding resistant trees are discussed in a comprehensive literature review. The main purpose of the report is to summarize knowledge which may be used in providing protection to a valuable species. Implicitly related topics are reviewed briefly, including sorption and emission of gases by plants, air quality standards, bioindicators for monitoring air quality, and silvicultural measures for protecting trees against injuries. (Katz)
W77-07829

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM.
National Marine Fisheries Service, Seattle, Wash. Available from Superintendent of Documents, USGPO, Wash. D.C. 20402 as C55.13:NMFS SSRF-681. NOAA Technical Report NMFS SSRF-681, October 1974. 35 p.

Descriptors: *Metals, *Cadmium, *Water pollution effects, *Physiology, Fishes, Stress, Sea water, Respiration, Bacteria, Immunization, Osmoregulation.
Identifiers: *New York bight, *Tautoglabrus adspersus*, Renal failure, *Cunners.

Six articles are brought together in this report on the response of the cunner to cadmium. The cunner was exposed to six concentrations of cadmium, as cadmium chloride, for 96 hr. At the end of this exposure period, tests of blood serum osmolality and gill tissue oxygen consumption were performed. High levels of this metal resulted in abnormally high serum osmolality, and an exposure as low as 3 ppm reduced the normal rate of oxygen consumption. The histopathological effects of acute exposure of the cunner to cadmium were manifested in the kidney, intestine, poietic tissue, epidermis and gill. The results implicate renal failure as the probable cause of death subsequent to acute exposure to cadmium. Clearance of intracardially injected bacteria from the blood of cunners exposed to 12 ppm cadmium was examined. The rate of bacterial uptake in the cells of the liver and spleen was increased, but the bacterial death rate within these cells was decreased. The activity of two liver enzymes changed significantly with exposure to cadmium. Chemical analyses were made for uptake and clearance of cadmium from exposed cunners. In the uptake study, cadmium residues averaged 8.5 times higher in liver than

in gills. In the clearance study, substantial productions in cadmium residues were found in the gills and blood of fish held in clean seawater for 6 wk after exposure to cadmium, as compared to fish sacrificed immediately after exposure. (See W77-07831 thru W77-07836) (NOAA)
W77-07830

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM. I. INTRODUCTION AND EXPERIMENTAL DESIGN,
National Marine Fisheries Service, Milford, Conn. A. Calabrese, R. S. Collier, and J. E. Miller.
In: NOAA Technical Report NMFS SSRF-681, Oct 1974. p 1-3, 11 ref.

Descriptors: *Marine fish, Bioassays, *Toxicity, Mortality, Laboratory tests, *Cadmium, *Heavy metals, Water pollution effects, Review, Aquaria, Fish physiology, Physiological ecology.
Identifiers: *Cunners, *Tautoglabrus adspersus*, *TLm (Median Tolerance Level), Physiological response.

The cunner was exposed to six levels of Cadmium for 96 hrs. Mortality data were obtained which indicated that cunners can tolerate high concentrations of Cadmium for at least 96 hrs. (See also W77-07830) (Katz)
W77-07831

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM. II. UPTAKE OF CADMIUM BY ORGANS AND TISSUES,
National Marine Fisheries Service, Milford, Conn. R. A. Greig, A. E. Adams, and B. A. Nelson.
In: NOAA Technical Report NMFS SSRF-681 Oct 1974. p 5-9, 2 tab, 2 fig, 9 ref.

Descriptors: *Cadmium, *Heavy metals, *Fish physiology, Marine fish, Bioassay, Laboratory tests, Water pollution effects, *Path of pollutants, Biochemistry, Chemical analysis, *Toxicity, *Pathology.
Identifiers: *Cunners, *Tautoglabrus adspersus*, Cadmium, Chloride, Cadmium uptake, Tissue uptake, *Cadmium clearance, Artificial seawater, Cadmium residues, Gills, Liver, Blood, Muscles, Fish blood, Liver concentrations, Serum.

Cadmium uptake and clearance data were obtained on cunners, *Tautoglabrus adspersus*, exposed to various concentrations of this metal in artificial seawater. In the uptake study, cunners were exposed to 0, 3, 6, 12, 24, and 48 ppm cadmium in seawater for 4 days. Cadmium residues averaged 8.2 times higher in livers than in gills. At the 48 ppm cadmium exposure level, the livers averaged 195 ppm, as compared to 33.5 ppm for gills (wet weight values). In the clearance study, cunners were exposed to 24 ppm cadmium in seawater for 4 days, after which time half of the fish were placed in clean flowing seawater for 1 mo and half were sacrificed immediately to determine initial cadmium residue concentrations. Gill, liver, blood, muscle, and carcass samples were analyzed. Substantial reductions in cadmium residues were found in the gills and blood of fish held in clean seawater, as compared to samples from fish sacrificed immediately after exposure to cadmium. Liver samples produced variable results: livers of fish held in clean seawater for 1 mo contained 62-155 ppm cadmium for four fish and 5-11 ppm for three fish, as compared to 30-117 ppm for livers from eight fish sacrificed immediately after exposure to cadmium. Muscle and carcass samples from the 'cleared' fish showed very little reduction in cadmium levels. (See also W77-07830) (Katz)
W77-07832

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO

CADMIUM. III. CHANGES IN OSMOREGULATION AND OXYGEN CONSUMPTION,
National Marine Fisheries Service, Milford, Conn. F. P. Thurberg, and M. A. Dawson.
In: NOAA Technical Report NMFS SSRF-681, Oct 1974. p 11-13, 1 fig, 18 ref.

Descriptors: *Cadmium, *Heavy metal, *Fish physiology, Marine fish, Laboratory tests, Water pollution effects, Path of pollutants, Biochemistry, *Oxygen metabolism, Respiration, *Oxygen requirements, *Bioassay.
Identifiers: *Cunners, *Tautoglabrus adspersus*, *Cadmium chloride, Blood serum osmolality, *Gill tissue oxygen consumption, *Oxygen consumption, Tissue damage.

The cunner, *Tautoglabrus adspersus*, was exposed to various concentrations of cadmium, as cadmium chloride ($CdCl_2 \cdot 2 H_2O$), for 96 hr. At the end of this exposure period tests of blood serum osmolality and gill tissue oxygen consumption were performed. High levels (48 ppm) of this metal resulted in an abnormally high serum osmolality and an exposure as low as 3 ppm reduced the normal rate of oxygen consumption. Both of these parameters may be related to observed tissue damage. (See also W77-07830) (Katz)
W77-07833

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM. IV. EFFECTS ON THE IMMUNE SYSTEM,
National Marine Fisheries Service, Milford, Conn. R. A. Robohm, and M. F. Nitkowski.
In: NOAA Technical Report NMFS SSRF-681, Oct 1974. p 19-20, 1 tab, 1 fig, 20 ref.

Descriptors: *Cadmium, *Heavy metals, *Fish physiology, Marine fish, Laboratory tests, Water pollution effects, *Path of pollutants, Biochemistry, *Fish diseases, Microbiology, Methodology, Public health, Toxicity.
Identifiers: *Cunners, *Tautoglabrus adspersus*, *Cadmium chloride, *Immune system, *Bacterial clearance, *Antibody production, Antibody response, Short-term exposure.

Two elements of the immune system in cunners, *Tautoglabrus adspersus*, were examined after 96-hr exposure to cadmium: (1) clearance of intracardially injected bacteria from the bloodstream and (2) ability to produce antibody against intraperitoneally injected sheep red blood cells (SRBC). Exposure to 12 ppm cadmium increased the rates of bacterial uptake in phagocytes of the liver and spleen but significantly decreased the rates of bacterial killing within these cells. Exposure of fish at 3 to 24 ppm cadmium failed to influence antibody production against SRBC. These results indicate that cadmium affects one aspect of cellular immunity but not humoral immunity in cunners. This effect may increase susceptibility to infection. (See also W77-07830) (Katz)
W77-07834

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGOLABRUS ADSPERSUS, TO CADMIUM. V. OBSERVATIONS ON THE BIOCHEMISTRY,
National Marine Fisheries Service, Milford, Conn. E. Gould, and J. J. Karolos.
In: NOAA Technical Report NMFS SSRF-681, Oct 1974. p 21-25, 3 tab, 1 fig, 16 ref.

Descriptors: *Cadmium, *Heavy metals, *Fish physiology, Marine fish, Laboratory tests, Water pollution effects, *Path of pollutants, Methodology, *Biochemistry, *Proteins, *Enzymes.
Identifiers: *Cunners, *Tautoglabrus adspersus*, *Cadmium chloride, Aspartate aminotransferase activity, Livers, *Metal-complexing proteins, Nicotinamide-adenine dinucleotide reductase activity.

In the liver of cunner, *Tautoglabrus adspersus*, exposed to 3 ppm and to 24 ppm Cd for 96 hr, aspartate aminotransferase activity was 71% and 59%, respectively, of the activity in livers of control fish. In the livers of cunners exposed to 24 ppm Cd, nicotinamide-adenine dinucleotide reductase activity required 20 mM Mg for activation of the same order that 2 mM Mg produced in control livers. Although individual variation precludes generalization here, what may be a metal-complexing group of proteins in the serum of cadmium-exposed cunner warrants further electrophoretic study. (See also W77-07830) (Katz) W77-07835

PHYSIOLOGICAL RESPONSE OF THE CUNNER, TAUTOGLABRUS ADSPERSUS, TO CADMIUM. VI. HISTOPATHOLOGY. National Marine Fisheries Service, Milford, Conn. M. W. Newman, and S. A. MacLean. In: NOAA Technical Report, NMFS, SSRF-681, Oct 1974, p 27-33, 8 fig, 20 ref.

Descriptors: *Cadmium, *Heavy metals, Fish physiology, *Fish diseases, Marine fish, Laboratory tests, Water pollution effects, *Path of pollutants, Methodology, Pathology. Identifiers: *Cunners, *Tautoglabrus adspersus*, *Cadmium chloride, *Histopathology, Kidney, Intestine, *Hemopoietic tissue, Epidermis, Gill, Renal failure, Necrosis, Blood components.

The histopathological effects of acute exposure of cunner, *Tautoglabrus adspersus*, to water containing cadmium chloride were manifested in the kidney, intestine, hemopoietic tissue, epidermis, and gill. Few significant changes were noted in fish exposed to concentrations less than 48 pp, for 96 hr. The results implicate renal failure as the probable cause of death after acute exposure to cadmium. (See also W77-07830) (Katz) W77-07836

EVALUATION OF ERYTHROCYTE DELTA AMINO LEVULINIC ACID DEHYDRATASE AS A SHORT-TERM INDICATOR IN FISH OF A HARMFUL EXPOSURE TO LEAD. Canada Centre for Inland Waters, Burlington (Ontario). P. V. Hodson, B. R. Blunt, D. J. Spry, and K. Austen. Journal of the Fisheries Research Board of Canada, Vol. 34, p. 501-508, 1977. 7 fig, 18 ref.

Descriptors: *Lead, *Heavy metals, Water pollution effects, Biochemistry, *Fish physiology, Laboratory tests, Path of pollutants, Fresh-water fish, *Rainbow trout, *Brook trout, *Sunfishes, Methodology, *Cadmium, *Copper, *Zinc, *Mercury, *Bioindicators, Pollutant identification. Identifiers: Goldfish, Pumpkinseed sunfish, Erythrocyte delta-amino levulinic acid dehydratase activity, *Sub-lethal effects, *Blood lead concentration.

The activity of erythrocyte (delta)-amino levulinic acid dehydratase (ALA-D) of fish is easily measured under a variety of experimental conditions. Exposure of rainbow trout (*Salmo gairdneri*), brook trout (*Salvelinus fontinalis*), goldfish (*Carassius auratus*), and pumpkinseed (*Lepomis gibbosus*) to lead consistently inhibited ALA-D within 2 wks at concentrations as low as 10, 90, 470, and 90 micrograms/liter, respectively. In rainbow and brook trout these concentrations were closely related to the published minimum effective concentrations causing sublethal harm. There was a significant linear relationship between ALA-D activity and log of lead in water, and between blood lead and lead in water. Near lethal exposures to cadmium, copper, zinc, and mercury did not significantly inhibit ALA-D activity. Recovery of ALA-D activity of rainbow trout after transfer from 120 micrograms/liter lead to clean water occurred in 8 wk. This enzyme provides fast, consistent, specific, and sensitive estimates of lead

concentrations causing sublethal harm to fish and may help to relate sources of lead to degree of exposure of fish populations in the field. (Katz) W77-07837

REDUCTIONS IN BIOMASS AND DIVERSITY RESULTING FROM EXPOSURE TO MERCURY IN ARTIFICIAL STREAMS. Savannah River Ecology, Aiken, S.C. C. F. Sigmon, H. J. Kania, and R. J. Beyers. Journal of the Fisheries Research Board of Canada, Vol. 34, p. 493-500, 1977. 4 fig., 2 tab., 23 ref.

Descriptors: *Mercury, *Metals, Water pollution effects, Path of pollutants, *Aquatic algae, Aquatic environment, Aquatic populations, *Aquatic productivity, Bioassay, Laboratory tests, Algae, Algidies, Food chain, Food pyramids, Aquatic insects, *Primary productivity, *Periphyton. Identifiers: *Artificial streams, Diversity.

Mercury levels similar to those in natural waters contaminated with mercury (0.1 and 1.0 micrograms/liter) caused significant reduction in algal numbers, standing stock, and diversity. Reductions in diversity resulted from a decrease in the evenness of distribution of numbers among species and a decline in the numbers of species. Although the algal community was affected by mercury ions, the magnitude of change was small at the mercury levels tested and the number of species affected were few. The decline in algal standing crop could indirectly affect other food chain members that possess physiological resistance to the mercury. There was no evidence of direct or indirect impact on the herbivorous or carnivorous midges. The impact on primary procedures was not sufficient to be transferred to consumer trophic levels. (Katz) W77-07838

EFFECTS OF THERMAL SHOCKS ON DRIFTING AQUATIC INSECTS: A LABORATORY SIMULATION. Virginia Polytechnic Inst. and State Univ., Blacksburg, Va. Dept. of Biology. F. F. Sherberger, E. F. Benfield, K. L. Dickson, and J. Cairns, Jr. Journal of the Fisheries Research Board of Canada, Vol. 34, p. 529-536, 1977. 4 tab., 14 ref.

Descriptors: *Bioassay, *Laboratory tests, Methodology, *Mayflies, Aquatic insects, *Aquatic drift, Aquatic populations, Water temperature, *Thermal pollution, *Thermal stress, Thermal water, Water temperature, Mortalities, Animal behavior, Predation, *Stoneflies. Identifiers: *Thermal shock, Acclimation, *Upper lethal temperatures, *Isonychia, *Hydropsyche, Phototaxis, Rheotaxis.

Effects of temperature shocks from thermal plumes on drifting Isonychia (Ephemeroptera: Baetidae) and Hydropsyche (Trichoptera: Hydropsychidae) larvae were examined in a laboratory simulation. Groups of both insects were collected at various seasons and acclimated in the laboratory at temperatures comparable to those in the field. Groups were exposed to thermal shocks of varying duration and observed for periods of 10 days afterward. Consistent statistically significant differences in mortality between treatment and control groups were not evident until shock temperatures neared the respective upper lethal limits for the two insects. While consistent treatment related differences in molting frequency in Isonychia were not obtained, changes in the patterns of molting were observed. Behavioral tests with Isonychia indicated no discernable treatment effects on rheotaxis, phototaxis, and substrate orientation. No discernable effects of treatment on susceptibility to predation of Isonychia by *Cottus caroliniae* were observed. (Katz) W77-07839

PROTECTIVE EFFECT OF CHLORIDE ON NITRITE TOXICITY TO COHO SALMON (*ONCORHYNCHUS KISUTCH*). Rhode Island Univ., Kingston. Dept. of Animal Science. S. J. Perrone, and T. L. Meade. Journal of the Fisheries Research Board of Canada, Vol. 34, p. 486-492, 1977. 7 tab, 15 ref.

Descriptors: *Salmon, *Bioassay, *Toxicity, Mortality, Laboratory tests, Fish physiology, Biochemistry. Identifiers: *Coho salmon, Yearling coho salmon, *Flow-through bioassay, *Methemoglobin.

Tolerance of coho salmon (*Oncorhynchus kisutch*) to nitrite was increased when the concentration of chloride ion in the environment was high. The results of flow-through bioassays revealed that no mortality occurred when yearling coho salmon were subjected to nitrite-nitrogen ($\text{NO}_2\text{-N}$) of 29.8 mg/l and chloride (Cl^-) of 261.3 mg/l for 48 h. When yearling coho salmon were exposed to 3.8 mg/l $\text{NO}_2\text{-N}$ and 2.5 mg/l Cl^- for 12 h, the resultant mortality was 58.3%. Possibly, chloride competes with nitrite for transport across the gills and integumental tissues, thereby interfering with the onset of nitrite-induced methemoglobinemia. (Katz) W77-07840

APPARATUS FOR PROLONGED MAINTENANCE OF SPECIFIC GAS CONCENTRATION IN THE WATER OF EXPERIMENTAL AQUARIA. Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. For primary bibliographic entry see Field 7B. W77-07841

EFFECTS OF INORGANIC COMPLEXING ON THE TOXICITY OF COPPER TO DAPHNIA MAGNA. Environmental Research Lab., Duluth, Minn. R. W. Andrew, K. E. Biesinger, and G. E. Glass. Water Research, Vol. 11, p. 309-315, 1977. 3 tab, 2 fig, 30 ref.

Descriptors: *Copper, *Heavy metals, *Toxicity, Mortality, *Bioassay, Crustaceans, *Daphnia, Laboratory tests, Carbonates, Bicarbonates, *Phosphates, Phosphorus compounds, Copper compounds, Methodology, Lake Superior, Hardness (Water). Identifiers: Mortality rates, Survival times, *Cupric ion, *Copper hydroxy ion, *Daphnia magna, Copper carbonate, Dissolved copper, Total copper concentration.

Effects of carbonate-bicarbonate, orthophosphate, and pyrophosphate on the toxicity of copper (II) to *Daphnia magna* were studied at constant pH and total hardness. Mortality rates and reciprocal survival times were directly correlated with cupric (Cu^{2+}) and copper hydroxy ($\text{Cu}(\text{OH})\text{m}$) ion activities as determined by equilibrium calculations. Toxicity was negatively correlated to activities of soluble copper carbonate (CuCO_3) and other complexes, and was found to be independent of dissolved copper or total copper concentrations. (Katz) W77-07842

EFFECTS OF CHLORINE AND CHLORAMINE ON UPTAKE OF INORGANIC NITROGEN BY PHYTOPLANKTON. Oklahoma State Univ. Stillwater. School of Biological Sciences. D. Toet, L. Varga, and M. Pierce. Water Research, Vol. 11, p. 253-258, 1977. 5 tab, 1 fig, 22 ref.

Descriptors: *Chlorine, *Phytoplankton, *Primary productivity, Nitrogen compounds, Nitrogen cycle, *Nitrogen fixation, *Nitrates, *Ammonia,

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Group 5C—Effects Of Pollution

Plant physiology, Plant growth, Plant populations, Enzymes, Absorption.
Identifiers: *Chloramine, Cell membranes.

Chlorine (Cl₂) and chloramine had a debilitating effect on the ability of phytoplankton to take up nitrate and ammonia. Chlorine at an initial concentration of 0.028 mg/l depressed uptake of nitrate by 50%. Uptake of nitrate and ammonia in the presence of 0.1 mg Cl₂/l or 0.1 mg chloramine/l did not follow Michaelis-Menten kinetics as did the respective controls. Small quantities of Cl₂ or chloramine may destroy or inactivate enzymes in the cell membrane that are responsible for uptake of nitrate. (Katz)
W77-07843

EGG HATCHABILITY AND TOLERANCE OF BROOK TROUT (SALVELINUS FONTINALIS) FRY AT LOW PH,
Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
J. R. Trojnar.
Journal of the Fisheries Research Board of Canada, Vol 34, p 574-579, 1977. 3 tab, 1 fig, 19 ref.

Descriptors: *Brook trout, *Fish eggs, Juvenile fish, *Bioassay, *Reproduction, Laboratory tests, *Hydrogen ion concentration, Mortality, Water quality, Methodology, Fish hatcheries, Aquaculture, *Fish physiology.

Hatchability of brook trout (*Salvelinus fontinalis*) eggs incubated at pH 4.6, 5.0, 5.6, and 8.0 ranged from 76 to 91%. Differential mortality was experienced when subsequent swim-up fry were exposed to a different pH indicating an acclimation effect. This suggests that brook trout fry incubated at lower, but sublethal, pH levels are less likely to experience acid-induced mortality upon emergence than those incubated in spring upwellings. (Katz)
W77-07844

ULTRASTRUCTURAL STUDY OF LESIONS IN GILLS OF A MARINE SHRIMP EXPOSED TO CADMIUM,
Environmental Research Lab. Gulf Breeze, Fla.
J. A. Couch.
Journal of Invertebrate Pathology, Vol. 29, p. 267-288, 1977. 22 fig., 11 ref.

Descriptors: *Cadmium, Animal diseases, *Animal pathology, Animal physiology, *Water pollution effects, *Metals, Bioassay, Laboratory tests, *Shrimp, Marine animals, Marine fisheries, Commercial shellfish, *Path of pollutants, *Environmental effects.
Identifiers: *Pink shrimp, *Penaeus duorarum*, *Cadmium chloride, Electron microscopy, *Gills, Cell death, Pathologic black gills.

Pathologic black gills of pink shrimp, *Penaeus duorarum*, exposed to 763 micrograms/liter of cadmium chloride for 15 days were studied with transmission electron microscopy and were compared with normal gills of control pink shrimp. Local as well as extensive areas of cell death and necrosis were found in the distal gill filaments of black gills from cadmium-exposed shrimp. It is proposed that necrosis of specialized epithelial cells in black gill filaments and contiguous nonblack gill tissue could cause osmoregulatory, detoxifying, and respiratory dysfunction in crustacea, particularly in individuals undergoing environmental stress such as salinity fluctuation. (Katz)
W77-07845

AQUATIC INSECT DIVERSITY AND BIOMASS IN A STREAM MARGINALLY POLLUTED BY ACID STRIP MINE DRAINAGE,
Pennsylvania State Univ., University Park. Dept. of Biology.
S. M. Tomkiewicz, Jr., and W. A. Dunson.

Water Research, Vol. 11, p. 397-402, 1977. 3 fig., 2 tab., 15 ref.

Descriptors: *Acid streams, *Acid mine water, *Populations, *Aquatic insects, *Biomass, *Acidic water, *Environmental effects, *Biological communities, Water pollution effects, Water pollution sources, Mine acids, Hydrogen ion concentration, Diptera, Invertebrates, Caddisflies, Sampling, On-site investigations.
Identifiers: *Species diversity, *Sialis*, *Ptilostomis*, Plecoptera, Upper Three Runs (Penn).

Upper Three Runs receives a point source of acid mine drainage from a small acid feeder stream and the pH of the main stream falls from above 6 to about 4.5. Over the 1.2 km study section below the introduction of acid drainage the pH rises to 5.0. This moderate degree of mine acid pollution has severely affected aquatic insect populations. The acid feeder (pH near 3.2) was inhabited only by a chironomid, a megalopteran (*Sialis*) and the caddisfly *Ptilostomis*. The drainage of the acid feeder into the stream caused a drop in the Shannon-Weiner diversity index from 3.10 to 1.95 and a drop in biomass from 6.5 to 2.2 grams per square meter. At two stations further downstream the biomass reached 1.2 grams per square meter. The number of taxa declined from 30 at the control station to 13 at the lowest site. Some Diptera and Plecoptera showed an increase in numbers as stream pH increased to about 5.0. (Katz)
W77-07846

INFLUENCE OF SOLVENTS ON THE PESTICIDE INHIBITION OF ATPASE ACTIVITIES IN FISH AND INSECT TISSUE HOMOGENATES,
Mississippi State Univ., Mississippi State. Dept. of Biochemistry.
D. Desai, and R. B. Koch.
Bulletin of Environmental Contamination and Toxicology, Vol. 17(1), p. 74-81, 1977. 3 tab., 9 ref.

Descriptors: *DDT, *Catfish, Fish physiology, *Enzymes, Biochemistry, *Chlorinated hydrocarbon pesticides, *Laboratory tests, *Methodology, Alcohols, Inhibition.
Identifiers: *Toxaphene, Plictran, *Benzene, *Cyclohexane, Hexane, *Ethanol, Pentane, Cyclopentane, ATPase, Brain tissue, Cockroach.

A number of solvents were tested to determine their effects on the inhibition of ATPase activities from catfish brain and cockroach muscle by DDT, toxaphene, and plictran. Solvents tested were ethanol, cyclohexane, hexane, benzene, pentane and cyclopentane. The solvents used for dissolving the pesticide had a great influence on the inhibitory action of the pesticides. Ethanol is the solvent of choice. (Katz)
W77-07847

EFFECT OF SALINITY ON THE FRESH-WATER SHRIMP DIKEROGAMMARUS HAEMOBAPHES (EICHWALD) FROM THE MOUTH OF THE DNEPR,
Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii.
S. A. Ponomareva.
Hydrobiological Journal, Vol. 11, No. 6, p. 67-69, 1975.

Descriptors: Animal physiology, *Salinity, *Shrimp, *Fish food organisms, Environmental effects, *Estuarine environment, *Osmotic pressure, *Adaptation, Estuaries, Laboratory tests, Crustaceans, Invertebrates, Lagoons, Rivers, Water pollution effects, Regulation.
Identifiers: *Dikergammarus, *Osmoregulation, *Dnepr River (USSR).

Regulation of river flow in the northwestern Black Sea area has caused a gradual increase in salinity in the lagoons and estuarine regions of the rivers. The effect of increasing salinity on the shrimp *Dikergammarus haemobaphes*, an important fish

food in the lower Dnepr, was tested in the laboratory by exposing the shrimp to salinities from 0.35 to 30 PPT. When the salinity is 12 to 15 PPT, the animals survive for slightly more than a month. The process of osmoregulation takes place rapidly with osmotic pressure of cavity fluid stabilized after 24 to 48 hrs. The high tolerance of *D. haemobaphes* to fluctuations in salinity up to 9 to 11 PPT is possibly the result of their ability to regulate the osmotic process.
W77-07848

A SECOND LOOK AT WATER REUSE,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-07908

REDUCTION IN SEWAGE CONTAMINATION IN SYDNEY ROCK OYSTERS,
New South Wales Univ., Kensington (Australia). School of Food Technology.
For primary bibliographic entry see Field 5G.
W77-07946

PHYTOPLANKTON PRODUCTION IN LAKE MEMPHREMAGOG, QUEBEC (CANADA)—VERMONT (U.S.A.),
P. E. Ross, and J. Kallf.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 760-769, 1975. 5 fig, 4 tab, 17 ref.

Descriptors: *Primary productivity, *Phytoplankton, *Estimating, *Lake basins, Lakes, Seasonal, Diurnal, Variability, Chlorophyll, *Vermont, *Canada.
Identifiers: *Lake Memphremagog (Quebec-Ve).

As part of an integrated ecosystem study of Lake Memphremagog, a 40 km long narrow glacial lake astride the Vermont-Quebec border which exhibits an axial nutrient gradient, investigations were made of seasonal patterns of phytoplankton primary production, efficiency of production and production per unit standing crop in the lake's three basins. The lake morphometry and bathymetry facilitates investigation of the three-way relationship because behavior of the phytoplankton was investigated in two or more distinct sections of the same lake and much of the variation due to climate, geology and chemistry is eliminated. Analyses of study results from the three lake basins showed that surface and cubic values for primary production, chlorophyll concentration and production efficiency all decreased from south to north, reflecting a gradient of decreasing nutrient supply. However, production measurements with oxygen and carbon-14 methods described by previous research yielded very different results. A method was developed for correcting daily production, estimated from short-term incubations with the aid of the daily light curve, to real daily production. Specific production, activity production, activity coefficients, and specific efficiency were similar in all three basins, indicating that the production on a per unit basis is similar throughout the lake. (Harris-Wisconsin)
W77-07962

PHYSICAL, CHEMICAL, AND BIOLOGICAL FACTORS IN THE INITIATION AND DESTRUCTION OF BIOGENIC MEROMIXIS IN A SOFT-WATER LAKE,
D. A. Culver.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 776-783, 1975. 3 fig, 4 tab, 10 ref.
AEC AT-(45-1)-2225-T23.

Descriptors: *Meromixis, *Water circulation, *Primary productivity, Inflow, *Lake morphometry, Lakes, Eutrophication, Siltation, Nutrients, *Thermal stratification, *Washington. Identifiers: *Hall Lake (Wash), *Downwelling currents, *Biogenic meromixis, Soft water lakes.

In lakes characterized by biogenic meromixis, in contrast to crenogenic and eotogenic meromictic lakes, the role of thermal phenomena, silt-laden inflow, morphometry and algal productivity must be considered along with chemical stratification to understand the circulation patterns. The present study utilized data from Hall Lake, a small, oval, soft-water lake in the Puget Sound area near Seattle, Washington. The data indicate that chemical resistance to mixing of the monimolimnion is less important than the magnitude of downwelling currents from the surface. In Hall Lake, silty inflows can destroy meromixis, but the effect of nutrient loading on algal productivity, and thus transparency and summer heat income, can decrease autumnal circulation enough to prevent complete overturn. The amount of circulation is directly related to the proportion of the lake which is heated above 4°C, and hence it is very sensitive to the transparency of the water, which is in turn affected by algal abundance, in turn controlled by nutrient income. The accumulation of materials in the deep water is important in restricting winter circulation, but both passive sinking and the inflow of silt-laden water can destroy the stratification, probably due to the sensitivity of the dissolved materials to the input of oxygen and to the small density differences involved. (Harris-Wisconsin)
W77-07963

WHOLE-LAKE EUTROPHICATION EXPERIMENTS WITH PHOSPHORUS, NITROGEN AND CARBON.

D. W. Schindler.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 3221-3231, 1975. 8 fig., 1 tab., 32 ref.

Descriptors: *Eutrophication, *Lakes, *Phosphorus, *Carbon, *Nitrogen, *Cycling nutrients, Sediments, Water quality control, Nutrients, Management, Nutrient removal. Identifiers: Lake restoration, Phosphorus cycle.

Several whole-lake experiments with additions of phosphorus, nitrogen, and carbon are described along with their implications for the management of eutrophication. Results indicate that the claim that control of carbon and other nutrients as well as phosphorus is necessary for effective eutrophication abatement is false. Carbon dioxide from the atmosphere supplied the carbon necessary to support increased production and algal blooms brought about by nitrogen and phosphorus additions, with the amount of carbon retained by the experimental lakes being closely related to the phosphorus control of the lakes. Termination of phosphorus input caused algal species composition to return to pretreatment levels within two years despite the continued addition of carbon and other nutrients. Examination of the phosphorus cycle indicated that hypolimnetic microplankton and sediments remove phosphorus with great efficiency, suggesting that the injection of phosphorus-rich effluents below the thermocline would prevent major algal blooms. Sediments were shown to effectively sequester phosphorus from the lake water and in cases where the depth of sediment mixing was much greater than the depth of sediment laid down each year, sediment phosphorus concentration did not rapidly change in response to changed loading regimes. (Luedtke-Wisconsin)
W77-07965

A CARBON BUDGET FOR LAKE ONTARIO, A. Robertson, and B. J. Eadie.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 291-299, 1975. 3 fig., 3 tab., 14 ref.

Descriptors: *Carbon cycle, *Lake Ontario, Calcium carbonate, Inflow, Discharge(Water), Sedimentation, Primary productivity, Equations, Equilibrium, Estimating, Canada, Great Lakes, Cycling nutrients.

Identifiers: *Carbon budget, Inorganic carbon, Organic carbon.

In the first carbon budget calculated for a large lake, separate data was utilized for eight Lake Ontario hydrochemical and other parameters: (1) inorganic carbon in the inflowing rivers; (2) organic carbon in the inflowing rivers; (3) net carbon fixed by primary production; (4) inorganic carbon in the outflow water; (5) organic carbon in the outflow water; (6) net exchange of carbon between the atmosphere and the inorganic carbon pool in the lake; (7) net calcium carbonate precipitation-dissolution; and (8) net sedimentary deposition-decomposition of organic matter. Monthly comparisons showed relatively stable inorganic and organic river inputs throughout the year, with peaks in primary productivity carbon fixation from the fourth-sixth study months. On the output side of the balance, inorganic river outflow, calcium carbonate, and river organic outflow were generally stable all 12 months. Sedimentary deposition and decomposition increased slightly in the middle study months, while gas carbon exchange decreased to a comparatively small fraction during the third to ninth study months. Overall input-output comparisons show a net input in the spring and summer and a net output in fall and winter. Primary production causes the input to peak in the warmer months and output is associated with mixing of supersaturated hypolimnetic waters into the upper layers in winter, releasing carbon dioxide to the atmosphere. (Harris-Wisconsin)
W77-07967

DIET PHOSPHATE FLUX IN LAKE WASHINGTON, U.S.A.,

J. E. Richey, A. H. Devol, and M. A. Perkins.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part I, p. 222-228, 1975. 5 fig., 1 tab., 20 ref.

Descriptors: *Diel migration, *Phosphates, *Cycling nutrients, Estimating, Primary productivity, Biomass, Trophic level, Phytoplankton, Absorption, Respiration, Zooplankton, *Washington, Lakes. Identifiers: *Phosphate flux, *Lake Washington(Wash).

An investigation attempted to assess diel phosphate fluxes in Lake Washington (Wash.) during a late-bloom period, repeatedly measuring mechanisms that determine the rate of change of the phosphate pool over depth during a day-night cycle. Phosphate was measured with the ascorbic acid-molybdenum blue method. Plankton and zooplankton respiration rates were estimated through electron transport system assay. Primary production was estimated by carbon-14 bicarbonate uptake and plankton biomass from ATP concentrations. Samples were taken from selected depths every three hours from 7 am May 22 to 4 pm May 23, 1974. Uptake measurements indicated that during the 36-hour period, only the phosphate and particulate pools were important in the flux. Maximum phosphate demand on the phytoplankton community was estimated by applying a carbon:phosphorus ratio of 105:1 to the maximum production rates observed. On May 22 phosphate demand was .28 micrograms P/l/hr. A similar calculation for the second day yielded a maximum phosphate demand of 0.13 micrograms P/l. These estimates account for only 19-33% of the observed phosphate flux. This observation, coupled with the presence of significant night phosphate uptake and a poor correlation of both respiration and phosphate uptake with primary production, indicated that bacterial respiration may have been supplying the energy for a significant fraction of phosphate uptake in Lake Washington at that time. (Harris-Wisconsin)
W77-07968

HYDROPHYTE BIOMASS AND COMMUNITY STRUCTURE IN A SMALL OLIGOTROPHIC NEW HAMPSHIRE LAKE.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 1004-1012, 1975. 5 fig., 1 tab., 33 ref.

Descriptors: *Biomass, *Aquatic plants, *New Hampshire, Ecological distribution, Distribution, On-site investigations, Productivity, Varieties, Habitats, Growth rates, Lakes, Eutrophication, *Oligotrophy.

Identifiers: *Hydrophytes, *Aquatic macrophytes, *Mirror Lake(NH).

A report summarizes hydrophyte biomass in Mirror Lake (New Hampshire) and discusses the probable hydrophyte contribution to the primary production of the 15-ha. oligotrophic lake. Mirror Lake vegetation, predominantly submersed, lacks emergent species. In shallow water diminutive species of isoetid ferns predominate, forming dense multispecific mats and clumps. Although the species distributions forms a vegetational continuum, three not-wholly arbitrary zones can be delimited. A shallow zone (2-2 m) has a relatively high biomass, about 15 g dry weight per square meter, contributed mostly by the mat species (71%). The significant contribution (21%) by floating-leaved species is notable in view of their infrequency (less than 1% of the bottom between 2-2 meters is colonized by them). Biomass of the mat vegetation may locally exceed 140 g sq m while that of the water lilies may reach 400 g sq m. An intermediate zone is marked by the rapid disappearance at about 2 m of the common shallow-water species, and by the biomass peaks at 2-2.5 m of *Utricularia purpurea* and *Isoetes tuckermanni*. Total biomass declines to low values (about 1.5 g dry weight sq m) at the base of this zone. A deep zone (5-7.2 m) is marked by the frequent appearance on boulders and cobbles of *Fontinalis* sp. and *Batrachospermum* sp., and on gyttja of *Potamogeton berchtoldi*, *Drepanocladus fluitans*, *Fontinalis* sp., and *Nitella flexilis*. Biomass increases between 6.5 and 7 m due to *N. flexilis* stands which locally exceed 40 g dry weight sq m. (Harris-Wisconsin)
W77-07969

PHOSPHORUS REGENERATION BY NATURAL POPULATIONS OF LIMNETIC ZOOPLANKTON,

R. H. Peters.

Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p. 273-279, 1975. 3 fig., 1 tab., 13 ref.

Descriptors: *Phosphorus, *Cycling nutrients, *Zooplankton, *Tracers, *Canada, Digestion, Lakes, Analytical techniques, Phosphorus radioisotopes, Daphnia, Crustaceans, *Lake Ontario, Bays, Great Lakes. Identifiers: *Phosphorus excretion, *Bay of Quinte(Lake Ontario).

Experimentally-determined rates of phosphorus excretion for Cladocera and Copepoda from different lakes were compared with limits of phosphorus excretion rates derived from a model developed in earlier research. The validity of the experimentally-determined rates were tested by comparison with phosphorus ingestion rates. Total community excretion was estimated from community grazing rates and, in one case, from the population weight and number. Experiments were conducted in late August-early September, 1971 and 1972 in two lakes in the Experimental Lakes Area of the Fisheries Research Board of Canada and in the Bay of Quinte in Lake Ontario. Zooplankton uptake of phosphorus from the lake water was analyzed using two variations of molybdenum blue reaction. Phosphorus content of the zooplankton was also measured for specific activity determination. Phosphorus ingestion rates were determined from the accumulation of radioactivity by zooplankton feeding in-situ on phosphorus-labelled *Rhodotula* cells for 5 minutes. After

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sorting of the labelled animals, weight and species-specific phosphorus ingestion rates were calculated, taking into account animal radioactivity counts, radioactivity of the feeding suspension and animal dry weight. Radioactivity of the total zooplankton can be used to calculate the community grazing weight for each stratum, in meter intervals. The measured excretion rates showed high variation among measured values, but were generally within the limits predicted from the model established in the earlier research. (Harris-Wisconsin)
W77-07972

TEMPORAL AND SPATIAL PATTERNS OF DINOFLAGELLATE BLOOMS IN LAKE KINNERET, ISRAEL (1969-1974).
U. Pollinger, and T. Berman.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 1370-1382, 1975. 9 fig, 3 tab, 21 ref.

Descriptors: *Pyrrophyta, *Dinoflagellates, *Seasonal, *Distribution, *Eutrophication, *Inhibition, Phytoplankton, Growth rates, Biomass, *Spatial distribution, *Temporal distribution, Distribution patterns, Lakes, Algae.
Identifiers: *Lake Kinneret (Israel), *Peridinium cinctum.

An outstanding feature of the cyclic growth pattern of algae in Lake Kinneret (Israel) is the annually-recurrent bloom of the dinoflagellate, *Peridinium cinctum* f. *westii*, which lasts from about January until June. During this time, *Peridinium* dominates the phytoplankton assemblage and constitutes more than 90% of the total algal bloom. The present research identifies some characteristics of the *Peridinium* cells and details concerning temporal and spatial development of the bloom from 1969-74. It was noted that similar bloom patterns occur in dry years or in those with normal rainfall. It is suspected that an extended run of dry years would eventually lead to lower algal standing crops. Extreme horizontal and vertical patchiness is a regular feature of dinoflagellate blooms. It is assumed that the vertical migrations of the *Peridinium* are advantageous in permitting the algae to optimize light and nutrient conditions, but details of the organism's reactions to light intensities and varying nutrient concentrations are not known. Other ongoing studies on *Peridinium*, both in the lake and in laboratory cultures, are aimed at the following questions: (1) whether the *Peridinium* cysts play an active part in initiating the bloom or whether this only starts from swimming vegetative cells in the water; (2) the kind of mechanisms that trigger the excystation and encystation processes. (Harris-Wisconsin)
W77-07973

NUTRIENT LIMITATION IN A SMALL OLIGOTROPHIC LAKE IN NEW HAMPSHIRE.
D. Z. Gerhart.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 1013-1022, 1975. 5 fig, 3 tab, 24 ref.

Descriptors: *Limiting factors, *Nutrient requirements, *Biomass, *Primary productivity, Nitrogen, *Phosphorus, *Bioassay, Projections, Analytical techniques, Cycling nutrients, Eutrophication, *New Hampshire, On-site tests, On-site investigations, Lumbering, Forest watersheds, Lakes, *Oligotrophy.
Identifiers: Nutrient limitation, Deforestation, *Mirror Lake (NH).

In a series of experiments to determine whether disturbances from nearby road building and housing construction might accelerate eutrophication in Mirror Lake (New Hampshire), carbon-14 bioassays, enrichments of chemostat cultures of the natural phytoplankton community, and in-situ enrichments of large (1700-liter) polyethylene enclosures were employed in studies of nutrient limita-

tion in the 15 ha oligotrophic lake. The present research deals with biomass changes in chemostat and polyethylene enclosures. In one of four chemostat bioassays, enrichment by nitrogen plus phosphorus of samples of Mirror Lake phytoplankton resulted in a 40% increase in carbon-14 uptake after only 10 hours, with production in the enriched chemostat nearly 5 times greater than that of the control sample by the third day. In experiments with polyethylene column enrichments, only nitrogen and phosphorus in combination stimulated growth. The experiments show that both nitrogen and phosphorus are required to stimulate phytoplankton growth in Mirror Lake and that stimulation occurs with these nutrients both at very high and very low concentrations. Using an analogous watershed as a model, it is seen that nitrate loadings to the lake from nearby deforestation would not by itself provide a dangerous level of nutrient input; but if phosphorus loading from sewage or other sources were to appreciably increase at the same time, there could be a substantial increase in algal production and standing crop. (Harris-Wisconsin)
W77-07974

INFLUENCE OF SUSPENDED SEDIMENT ON THE TEMPERATURES OF SURFACE WATERS OF RESERVOIRS.
F. R. Schiebe, J. C. Ritchie, and J. R. McHenry.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, Part I, p 133-136, 1975. 2 tab, 2 ref.

Descriptors: *Suspended load, *Water temperature, *Turbidity, *Solar radiation, *Reflectance, Sediment load, Suspended solids, Aquatic environment, Reservoirs, *Mississippi, Sedimentation rates, Agricultural runoff.

Comparative studies on two small northern Mississippi reservoirs shows that suspended particles in the surface water may scatter solar radiation, with the resultant energy loss reducing surface temperatures and overall heat content levels of the entire impoundment. Even slight shifts in temperature can cause significant alterations in the aquatic ecosystem and thus affect water quality, speciation and numbers of fish available for harvest from agricultural reservoirs. The two reservoirs selected for measurement, with respective watershed areas of 82.1 hectares and 86.3 hectares, are adjacent to each other but have contrasting concentrations of suspended sediments; the watershed of one is primarily cultivated land while the other is mostly forested. Measurements of temperature profile, incident and reflected solar radiation, Secchi depth and concentrations of suspended sediments in the surface waters were made for one year in 1973-74. Equilibrium temperatures representing surface temperature of a body of water after a period of time for any given set of meteorological parameters were assumed to be identical for the reservoirs because of proximity, and a comparison of surface temperatures taken throughout the study period showed that the reservoir with the least turbidity contained the greatest amount of energy. (Harris-Wisconsin)
W77-07975

OXYGEN UPTAKE OF SEDIMENTS IN CASTLE LAKE, CALIFORNIA.
P. A. Neame.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, p 792-799, 1975. 6 fig, 2 tab, 11 ref. NSF 35371.

Descriptors: *Oxygen, *Adsorption, *Lake sediments, *Oxygen demand, *Benthos, *Sediment-water interfaces, Photosynthesis, Oxidation-reduction potential, Respiration, Oxygenation, *California, Lakes.
Identifiers: *Castle Lake (Calif).

Research was conducted to determine depth of penetration of oxygen into the sediments and to evaluate magnitudes of oxygen demand by various

components of the Castle Lake, California, benthic community. Oxygen profiles were determined from sediment samples, and redox potential was measured; microbial, macrofaunal, and sediment oxygen uptake rates were determined as was benthic oxygen production. Analysis of the resultant measurements for diffusion and mass transport, photosynthetic oxygen production, microbial chemical and macrofaunal oxygen uptake show that macrofauna respiration accounts for only a small part of total oxygen uptake. Microbial and chemical oxygen uptake consume more than 95% of the oxygen diffusing into each layer of the sediment. Photosynthetic production of oxygen in the first sediment layer is much greater than diffusion into that layer from the overlying water. Molecular diffusion across the sediment-water interface is insufficient to maintain the observed oxygen profiles. It is hypothesized that mass transport may be important in moving into the sediments. Respiratory movements of the macrofauna would, therefore, seem to be more important than their respiratory uptake per se in determining the observed oxygen uptake rate of the Castle Lake sediments. (Harris-Wisconsin)
W77-07976

PLANKTONIC PRIMARY AND BACTERIAL PRODUCTIVITY IN SHALLOW WATERS WITHIN A LARGE PHRAGMITES COMMUNITY (NEUSIEDLERSEE, AUSTRIA).
M. Dokulil.

Verhandlungen Internationale Vereinigung Limnologie, Vol 19, Part II, p 1295-1304, 1975. 8 fig, 24 ref.

Descriptors: *Productivity, *Phytoplankton, *Bacteria, *Bulrushes, Foreign countries, Littoral, Ice cover, Biomass, Seasonal, *Primary productivity, Lakes.
Identifiers: *Neusiedlersee (Austria).

Primary production measurements taken in 1968-1969 in the Scirpis-Phragmites community of the Neusiedlersee (an Austrian lake) as related to total incoming radiation, are described. The low under-ice phytoplankton biomass increased just before ice break-up and decreased until mid-June, followed by a rapid peak in August, which was dominated by *Cryptomonas*, forming 83% of the total biomass. Later in the year with decreasing biomass, diatoms predominated. Bacterial biomass was high in winter and early spring and decreased after ice break-up until the end of August; in autumn, bacteria numbers increased and tended to fluctuate around 3 mg C/cu m until the end of the year. Autotrophic production was related to the increase in the bulrush biomass; heterotrophic production was generally highest in winter and autumn. Dark-carbon uptake and bacterial biomass were highly correlated whereas neither dark-C14-uptake and phytoplankton biomass, nor photosynthesis and dark assimilation appeared to be significantly correlated; thus bacteria were responsible for most of the dark uptake. Bacteria production exceeded primary production more than 10 times in October 1968 and more than 45 times in October 1969. Autotrophic and heterotrophic production, phytoplankton dynamics, and energy flows are diagrammed and discussed. (Auen-Wisconsin)
W77-07977

MICROBIAL ATP STUDIES.
B. K. Burnison.
Verhandlungen Internationale Vereinigung Limnologie, Vol 19, Part I, p 286-290, 1975. 2 tab, 9 ref.

Descriptors: *Bacteria, *Measurement, *Biomass, *Analytical techniques, Carbon, Filtration, Separation techniques, Bioassay, Microbiology, Pollutant identification.
Identifiers: *Adenosine triphosphate, Nucleopore filters, Millipore filters.

Analysis for bacterial adenosine triphosphate (ATP) and subsequent calculation of bacterial biomass (microgram C/I) by subtracting the phytoplankton carbon derived from total ATP measurements rests on the accuracy of particle size fractionation. The efficiency of size fractionation by Nuclepore filters, as opposed to Millipore filters, is substantiated by the described experimental procedures. Use of screens and Nuclepore filtration is an accurate technique to separate bacterial biomass from that of other aquatic life forms. It has been previously shown that a 10 micron nylon screen will separate bacterial and/or yeast populations from the remaining biomass depending on the size of predominant phytoplankton species. Microscopic examination of the filtrates should be made of the initial water sample to ensure that the bacterial count is not being significantly changed and there are no other life forms present. One disadvantage of Nuclepore filters is that they are unsuitable for filtering large volumes of particulate matter because the pores do plug up, but continuous washing or agitation may alleviate this problem. However, the extreme sensitivity of the ATP assay should negate the necessity of using large volumes. (Auen-Wisconsin)

W77-07978

POPULATION ECOLOGY AND PRODUCTION OF BENTHIC DETRITIVORES,

P. M. Jonasson.

Verhandlungen Internationale Vereinigung Limnologie, Vol 19, Part II, p 1066-1072, 1975. 3 fig., 3 tab., 6 ref.

Descriptors: *Benthic fauna, *Productivity, *Life cycles, Food habits, Diptera, Tubificids, Growth rates, Foreign countries, Detritus, Lakes, Productivity.

Identifiers: *Detritivores, *Lake Esrom(Denmark), Chironomus anthracinus, Potamogeton hammoniensis.

Differences in the ecology and production of the surface feeding detritivore Chironomus anthracinus and the subsurface feeding Potamogeton hammoniensis were studied in the temperate Lake Esrom, Denmark. Their metabolic activity seems mainly to depend on temperature and oxygen supply. C. anthracinus has a much higher metabolic rate than the subsurface feeder, which is especially remarkable at the lower oxygen concentrations, because its critical limit for oxygen uptake is slightly lower than for P. hammoniensis. The surface feeder lives nearer to recently-produced food, while the subsurface feeder utilizes bacteria and organic compounds which likely have passed through the intestine of the surface feeder. Thus C. anthracinus feeds on high energy food at the mud surface whereas P. hammoniensis feeds on subsurface low energy food. The surface feeder has a much higher growth rate—its life cycle is 1-2 years versus 4-6 years; production is ten times higher—75.3 kcal sq m versus 7.9 kcal sq m. Turnover rates are much higher for C. anthracinus (4.0 for the first year and 0.8 for the second year) than for P. hammoniensis (0.82). (Auen-Wisconsin)

W77-07979

VISUAL OBSERVATIONS OF PHOSPHORUS MOVEMENT BETWEEN ALGAE, BACTERIA, AND ABIOTIC PARTICLES IN LAKE WATERS,

Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.

H. W. Paerl, and D. R. S. Lean.

Journal of Fisheries Research Board of Canada, Vol. 33, No. 12, p. 2805-2813, 1976. 18 fig., 20 ref.

Descriptors: *Analytical techniques, *Cycling nutrients, *Phosphorus, *Sorption, *Algae, *Bacteria, Detritus, *Canada, Phosphates, Lakes, Path of pollutants.

Identifiers: *Biotic phosphorus excretion, *Autoradiography, *Lake Hart(Ontario).

Rapid transfer of phosphorus from dissolved phosphate to the particulate fraction has been observed in lake waters during summer but the relative importance of uptake by algae, bacteria, or abiotic particles has been undefined. Using autoradiography combined with tracer kinetics this investigation noted the transfer of P₃₃-phosphorus into plankton and the appearance of labeled colloidal material within minutes. By combining microautoradiography and scanning electron microscopy, microscopic forms of algae, bacteria, detritus and colloidal matter were separated to learn the sequence in which bacteria, algae, and suspended particles remove P₃₃-phosphorus from solution and to determine the physical appearance of excreted material suspected of containing labeled phosphorus. Bacteria initially showed much more dense labeling but, since the algal biomass greatly exceeds the bacterial biomass, algal P₃₃-phosphorus incorporation represented the most significant uptake pathway. After 2 hours, P₃₃ accumulated in both the detrital aggregates which were harboring bacteria and the 'capsular' material surrounding Anabaena. Examination showed fibrillar and amorphous particles of colloidal size (.05-0.5 micrometer). It is suggested that constituents of a colloidal pool of phosphorus are microscopically similar to extracellular products of cell metabolism. In view of the fact that phosphorus is a growth-limiting factor in most lakes, several diverse hypotheses are considered to explain why phytoplankton and bacteria excrete copious amounts of phosphorus, and its ecological significance. (Auen-Wisconsin)

W77-07983

STABILITY IN STRUCTURE AND FUNCTION OF THE MUD-WATER INTERFACE,

B. T. Hargrave.

Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 1073-1079, 1975. 2 fig., 1 tab., 14 ref.

Descriptors: *Sediment-water interfaces, *Mud-water interfaces, *Oxidation-reduction potential, *Stability, Respiration, Oxygenation, Biochemical oxygen demand, Chemical oxygen demand, Lakes, Bays, Canada.

Identifiers: *Lake Esrom(Denmark), *Bedford Bay Basin(Nova Scotia).

Observations in Lake Esrom, Denmark and Bedford Bay, Nova Scotia confirm two postulates: (1) that an intact sediment-water interface has physical and chemical stability properties which regain equilibrium levels soon after disturbance; and (2) that the depth of the surface oxidized layer can be thickened by aeration only to a limited extent, thus establishing a balance between oxygen supply and utilization. Temporal changes in the depth of oxygen penetration and rates of oxygen uptake partitioned between chemical oxidation and biological respiration were compared to indicate that physical stratification and metabolic processes within a sediment-water interface are closely related and rapidly stabilized to steady-state levels after disturbance. Changes in redox profiles in reconstituted mud cores from the lake and the marine bay indicated rapid formation of an oxygenated mud-water interface to a depth similar to that observed in freshly-collected undisturbed cores. Measurements of oxygen uptake, initially high during re-stratification, demonstrated that chemical oxidation is replaced by biological respiration due to bacterial colonization, which approaches equilibrium within two weeks. The addition of tube-dwelling invertebrate or debris from a senescent algal culture did not significantly alter either the final equilibrium level of community metabolism or the rate at which it is achieved. (Auen-Wisconsin)

W77-07985

THE CONTRIBUTION OF AUTOCHTHONOUS AND ALLOCHTHONOUS MATTER TO THE

TROPHY OF A RIVER IN THE BARBEL REGION,

Lodz Univ. (Poland). Dept. of Comparative Anatomy and Animal Ecology.

T. Penczak, M. Molinski, and M. Zaleski.

Ekologia Polska, Vol. 24, No. 1, p. 113-121, 1976. 3 fig., 3 tab., 20 ref.

Descriptors: Rivers, *Energy budget, *Seston, *Phytoplankton, Nutrients, Primary productivity, *Organic matter, *Trophic level.

Identifiers: *Pilica River(Poland), *Allochthonous matter, Nutrient sources, *Autochthonous matter.

Caloric contributions of phytoplankton and of seston were measured in the Pilica River, below the mouth of the River Czarna Konecka, Poland. Mean annual respiration was about 14% gross production and mean annual gross production was 538.43 mg oxygen/sq m/24 hr. As based on caloric oxygen equivalent, the amount of chemical energy produced was 689.73 kcal/sq m/yr. Phytoplankton production was measured by dark-light bottle technique. Quantitative seston samples were taken by filtering water through a planktonic No. 25 net and by means of water centrifugation, then dried or combusted. The centrifugation method proved several times more efficient. The caloric value of seston in an annual cycle ranged from 1.03040 to 2.1267 cal/mg dry weight. The caloric value of organic matter in 1 cu m of water averaged 5990.4 cal and the flow of organic matter in the river bed cross section was 152.75 kcal/sec, which corresponds to about 13,000 megacal/24 hr. Comparison of the caloric value of the autochthonous matter to the caloric value of seston per 1 cu m water, indicated that the role of phytoplankton in the fertilization of the river is slight when compared to the allochthonous input. (Auen-Wisconsin)

W77-07986

THE INVERTEBRATES ON SUBMERGED MACROPHYTES IN THREE MASURIAN LAKES,

Warsaw Univ. (Poland). Dept. of Hydrobiology.

G. J. Soszka.

Ekologia Polska, Vol. 23, No. 3, p. 371-391, 1975. 12 fig., 5 tab., 50 ref.

Descriptors: *Invertebrates, Mollusks, Oligochaetes, Midge, *Submerged plants, Pondweeds, Aquatic plants, *Littoral, *Benthos, Benthic fauna, Biological communities, Lakes, Biomass, Census, Population.

Identifiers: *Macrophytes, Potamogeton lucens, Potamogeton perfoliatus, Myriophyllum spicatum, Elodea canadensis, Composition, *Poland(Masurian lakes).

The composition and number dynamics of invertebrates inhabiting the submerged macrophytes, Potamogeton lucens, P. perfoliatus, Myriophyllum spicatum, and Elodea canadensis, were analyzed and compared with littoral benthos. The community of invertebrates found to associate with macrophytes consisted of a variety of groups having different biology, with Chironomidae, Oligochaeta and Mollusca the most abundant. The numbers of invertebrates changed noticeably over time, space, and on different species of macrophytes. Numbers of invertebrates were larger on P. lucens and P. perfoliatus than on E. canadensis and M. spicatum, but because the E. canadensis and M. spicatum biomass per square meter on the littoral bottom was greater, the numbers of fauna per square meter on the bottom area overgrown with these macrophytes was larger than in the pondweed environment. Analysis of benthos close to these macrophyte-associating fauna indicated that although the same groups of invertebrates dominated, the species composition of these groups and the number dynamics of both communities varied, and the littoral benthos was usually less abundant. While the macrophyte-associating invertebrates and benthic fauna came into contact, differences in composition and num-

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects Of Pollution

bers showed that these were two different communities. (Luedtke-Wisconsin)
W77-07987

THE INFLUENCE OF MINERAL FERTILIZATION ON PHYTOPLANKTON PRODUCTION IN LAKES OF VARIOUS TROPIC TYPES.
Instytut Rybactwa Środlądowego Olsztyn Kor-towo (Poland). Zakład Hydrobiologii.
B. Zdanowski.
Ekologia Polska, Vol. 24, No. 2, p. 167-195, 1976. 16 fig., 5 tab., 75 ref.

Descriptors: *Lakes, *Phytoplankton, *Productivity, Nitrogen, Phosphorus, Potassium, Lime, *Trophic level, *Dystrophy, *Eutrophication, Hydrogen ion concentration, Water chemistry, Respiration, Lake morphology, *Fertilization, Secchi disks, Light penetration, Water temperature.
Identifiers: Lake Smolak (Poland), Lake Pieciek (Poland), Lake Dgal Maly (Poland), Lake Czarna Kuta (Poland), Water transparency.

Phytoplankton production changes under the influence of mineral fertilization was studied over the period 1970-1974 on four lakes with different trophic and morphometric conditions. Nitrogen and phosphorus were applied to all lakes three times per year, and potassium was added once a year to three of them. Liming of the dystrophic lakes was carried out each winter. The greatest water chemistry changes were noted in the two dystrophic lakes, Smolak and Pieciek. Changes included a constant increase in calcium and potassium content, a higher pH value, and a higher electrolytic conductivity, however, no changes were noted in nitrogen and mineral salt content. The higher production growth was also found in the dystrophic lakes. Gross production in Lake Smolak showed an increase from around 0.5 to 3.1 mg of oxygen/l/day together with a drop in water transparency and share of respiration in gross production. Lake Pieciek showed an increase from about 1.5 to 6.5 mg of oxygen/l/day with no changes in water transparency and share of respiration. No production changes were found in the deep Lake Dgal Maly throughout the study period, while the maximum production period moved from autumn to summer in the shallow eutrophic Lake Czarna Kuta. The latter was accompanied by a drop in production below 1 m, a drop in water transparency and light conductivity, and a growth in the variability of the share of respiration in gross production. (Luedtke-Wisconsin)
W77-07988

PHOSPHORUS: CHANGES IN ECOSYSTEM METABOLISM FROM REDUCED LOADING.
D. R. S. Lean, M. N. Charlton, B. K. Burnison, T. P. Murphy, and S. E. Millard.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part I, p. 240-257, 1975. 7 fig., 1 tab., 17 ref.

Descriptors: *Phosphorus, *Bottom sediments, *Cycling nutrients, Productivity, Algae, Nitrogen, *Canada, On-site investigation, *Lake Ontario, Lakes, Bays, Path of pollutant, *Metabolism.
Identifiers: *Bay of Quinte (Ontario).

Phosphorus movement between sediments and overlying waters that remained unstratified and that were never anoxic was investigated in eutrophic Bay of Quinte on the northern shore of Lake Ontario, where the respective loading rates for phosphorus and nitrogen were 1.46 and 19.0 g/sq m. The investigations were conducted by means of 25 sq m enclosures, one fertilized with 0.707 g phosphorus/wk and a second to which a similar amount of phosphorus was added and also 9.19 g nitrogen/wk, with the movement of phosphorus compared to a control enclosure. In addition to phosphorus movement within the community, exchange rates between the open water,

the littoral zone and the sediments was measured with isotopelabeled phosphorus. The results indicated that concentration of phosphorus in water is controlled by sediment properties. Net release of large amounts of biologically-available phosphorus occurred only after energy input of sedimenting organic matter during the summer. Net phosphorus movement in water was to the sediments. Thus reduction of nutrient input to shallow lakes may not change the total analytical phosphorus concentration but since the load of sedimenting material would be reduced, heavy mid-summer algal blooms would occur less frequently. (Auen-Wisconsin)
W77-07989

SEDIMENTATION: MEASUREMENTS IN EXPERIMENTAL ENCLOSURES.
M. N. Charlton.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part I, p. 267-272, 1975. 4 fig., 3 tab., 9 ref.

Descriptors: *Sedimentation, *Measurement, *Nutrients, *Canada, Phosphorus, Dispersion, Cycling nutrients, On-site investigations, Lake Ontario, Lakes, Bays, Pollutant identification.
Identifiers: *Bay of Quinte (Ontario).

Nutrient accumulation in sediments was measured by sedimentation rates in equilateral triangular experimental enclosures (limnocorrals) containing about 100,000 liter of water and associated sediments in the Bay of Quinte, Ontario. The experiment used three containers enriched respectively with phosphorus plus nitrogen, phosphorus alone, and an unenriched control. Dry weight sedimentation was generally the same in all corals, but sedimentation in the coral receiving phosphorus plus nitrogen was usually greater than in the enclosure receiving only phosphorus and the control. The results were consistent with those measured in open lake water and may be used for calculation of phosphorus sedimentation. The traps did not measure storage but rather the rate at which phosphorus arrived at the bottom to be recycled, although actual return rates must have been higher than settling rates in order to support aufwuchs growth on the sides of the coral. If the role of phosphorus already stored in sediments is neglected, then water column phosphorus in corals I, II and III would be recycled 12, 14, and 34 times per year, respectively, at the rates computed from the experiments. (Auen-Wisconsin)
W77-07990

BACTERIAL DECOMPOSITION OF DIFFERENT POLYSACCHARIDES IN A EUTROPHIC LAKE.
W. Reichardt.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2636-2642, 1975. 4 fig., 9 ref.

Descriptors: *Carbohydrates, *Biodegradation, *Bacteria, *Eutrophication, Productivity, Carbon, Europe, Organic compounds, Water temperature, Cycling nutrients, Lakes.
Identifiers: *Polysaccharide biodegradation, *Mindel Lake (Germany).

Laboratory experiments using water samples from Mindel Lake, near Constance, West Germany, were conducted with natural strains of *Cytophaga* species and *C. johnsonae* in pure cultures to determine bacteria population densities sufficient to degrade various solid, beta-linked polysaccharides to provide an indicator of the potential of biodegradation. Population density sufficiency for degradation of solid polysaccharides were determined on mineral agar containing suspensions of either chitin, xylane or cellulose. Bacterial degradation of these substrates was indicated by clearing zones around the colonies. However, peptone or yeast extract seemed to suppress this reaction. When grown on nutrient broth or glucose, *Cytophaga* sp., the most predominant

polysaccharide degrading bacteria in the lake, was inhibited on two levels: (1) in mixed cultures the dissolved organic matter prevented *Cytophaga* from competing successfully with other populations, and (2) in pure cultures of *C. johnsonae* it repressed the production of chitinases. Culture experiments indicated that not only are carbon sources efficient in the environmental control of bacterial degradation of polysaccharides, but temperature was also able to control the competition of the polysaccharide degrading *Cytophaga* with other bacteria, as well as their production of polysaccharide-degrading enzymes. (Auen-Wisconsin)
W77-07991

ELECTRON TRANSPORT ANALYSIS AS AN INDICATOR OF BIOLOGICAL OXIDATION IN FRESHWATER SEDIMENTS.
A. P. Zimmerman.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 1518-1523, 1975. 3 fig., 10 ref.

Descriptors: *Analytical techniques, *Biodegradation, *Oxidation reduction potential, *Bottom sediments, Microorganisms, Metabolism, *Georgia, Lakes, *Bioindicators.
Identifiers: *Electron transfer, Tetrazolium analysis, *Lake Jackson (Geo).

Tetrazolium analysis detects the potential for electron transfers in microorganisms regardless of whether they are aerobic, anaerobic or fermentative and this non-discrimination may be useful in determining biological oxidation capacities of sediments. A theoretical model can be constructed for microbial electron transport; from eucaryotic data, one can determine the reduction activity of INT or (2-p-iodophenyl)-(3-p-nitrophenyl)-5-phenyl tetrazolium chloride and thus measure the activity on any metabolic pathway which includes the flavo-protein-cytochrome pathway. This electron transport system analysis was tested on sediment cores taken from Lake Jackson in southeast Georgia, and showed that pheophytin and pollen particularly indicate a high rate of sedimentation. Preliminary experiments showed that electron transport system activity response of exhausted and non-exhausted sediments to various organic and inorganic substances differs; thus tetrazolium salts can be used successfully in detecting electron transfers in sediments and the analysis itself is useful in determining the capacity of a system for biological generation of electrons. Its use in a lake with an unusually high sedimentation rate may be helpful in explaining the relationship between the biological and chemical reactions of sediments and in assessing the impact of watershed hydrographic events on lake sediments. (Auen-Wisconsin)
W77-07992

PLANKTONIC MICROBIAL HETEROTROPHY: ITS SIGNIFICANCE TO COMMUNITY BIOMASS PRODUCTION.
R. H. Monheimer.
Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 2658-2663, 1975. 1 fig., 1 tab., 13 ref. SNF GB-3994.

Descriptors: *Analytical techniques, *Microorganisms, *Productivity, Measurement, Sulfates, Aerobic conditions, Biomass, Microbiology.
Identifiers: *Heterotrophic production.

A method of measuring microbial heterotrophic production by sulfur uptake is proposed. The idea of using sulfur as a yardstick is based on the presence of carbon and sulfur innaturally-occurring organic matter at an average 500:1 ratio; under aerobic conditions, a microbial community utilizes sulfate as its primary sulfur source, and organic sulfur uptake by microplankton is insignificant as compared to the uptake of sulfate-sulfur. Therefore, since sulfate is the only significant source of

sulfur utilized by aerobic microplankton, sulfate uptake should be representative of total biomass production at an average 500:1 C:S ratio. The technique is basically the same as the carbon-14 method for determining primary production except that sulfur-35 labeled sulfate is used and ambient sulfate concentrations must be measured. Laboratory measurements of microbial heterotrophy assumed that if photosynthesis was the only process taking up carbon and sulfate when incubation occurred in the light, then the measured C:S uptake ratios should vary around and average out to 500:1, i.e., more sulfate-sulfur was taken up than could be accounted for by photosynthesis alone, thus the high sulfate uptake must have been caused by microbial heterotrophic production. How to partition the heterotrophic from the photosynthetic production is described. (Auen-Wisconsin). W77-07993

OPTIMAL GROWTH TEMPERATURES AND MEDIA PARAMETERS OF BACTERIAL COMMUNITIES FROM LAKES OF DIFFERENT TROPIC STATES,

R. Guerrero, F. Roda, C. Abella, and F. Torrella. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2620-2626, 1975. 2 fig., 4 tab., 5 ref.

Descriptors: *Bacteria, *Growth rates, *Trophic level, Density, Physiological ecology, Nutrient requirements, Water temperature, Europe, Cultures, Analytical techniques, *Lakes. Identifiers: *Spain(Lakes).

Parameters useful in determining bacterial populations adapted to specific temperatures and nutrient factors are discussed; a description is given of media and temperature differentials to distinguish between bacterial types grown on agar plates, to facilitate distinguishing between similar plate counts. Samples were collected from oligotrophic, mesotrophic, eutrophic, and heavily polluted lakes in northeastern Spain. The plate count method was used to construct quotients, defined as an 'auxotrophy index' (Ia)—representing bacteria that can grow on a rich medium (CPS) but not on a poor one; and a 'psychrophilic index' (Ip)—indicating the ratio of bacteria that can grow at 20°C but not at 37°C. Thus in oligotrophic lakes Ia is small relative to Ip, while the reverse is true in highly eutrophic lakes. In an oligotrophic lake the number of bacteria adapted to live exclusively under auxotrophic conditions is much lower than the number adapted to the psychrophilic life. The contrary happens in a highly eutrophic lake, thus the concentration of organic material and growth factors is much higher in a eutrophic lake and this higher concentration somehow changes the species composition of the bacterial community, and consequently their adaptation to the changing environment. (Auen-Wisconsin). W77-07994

THE INFLUENCE OF TEMPERATURE AND BACTERIAL NUMBERS ON THE HETEROTROPHIC UPTAKE OF C14 GLUCOSE IN WEST BLUE LAKE, MANITOBA,

G. G. C. Robinson, and L. Brandt. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2616-2619, 1975. 2 tab., 12 ref.

Descriptors: *Productivity, *Organic compounds, *Carbon, *Absorption, *Bacteria, Radioactivity techniques, Tracers, *Water temperature, *Canada, Cycling nutrients, Analytical techniques, Lakes. Identifiers: *West Blue Lake(Manitoba), *Heterotrophic uptake.

The influence of temperature upon bacterial uptake of C14 glucose was investigated in West Blue Lake, Manitoba, by experiments in which uptake was determined throughout the water column, and consequently at different environmental tempera-

tures, and then the maximum uptake velocity calculated. On three sampling dates during summer 1972, a positive correlation was found between uptake and temperature, although the composition of the bacterial population may have differed. Analysis of covariance indicated no significant difference between slopes of the lines calculated for each experiment although there were differences in intercepts. On the basis of the covariance analysis, the data was combined and a Q10 value of 3.129 was calculated. If it is assumed that uptake of C14 glucose represents at least a partial measure of potential bacterial production, then it is apparent from the results that both environmental temperature and plate counts of bacteria contribute to such production. (Auen-Wisconsin) W77-07995

EXTRACELLULAR RELEASE IN PLANKTONIC BACTERIA,

T. G. Dunstall, and C. Nalewajko. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, p. 2643-2649, 1975. 3 fig., 1 tab., 25 ref.

Descriptors: *Productivity, *Organic compounds, *Bacteria, *Exudation, Microorganisms, *Carbon, Plankton, Pseudomonas, Organic matter, Cycling nutrients, Primary productivity, Waste assimilative capacity.

In primary production experiments any dissolved organic compounds in the filtrates are assumed to be of algal origin, however assimilation of organic carbon excreted by algae and subsequent excretion of dissolved organic carbon by bacteria may also contribute to the extracellular carbon pool and thus modify the composition and the quantity of dissolved organic matter originally excreted by the algae. Extracellular compounds excreted by *Pseudomonas fluorescens* were investigated on glucose, fructose or sucrose substrates with indications that with these substrates excretion if *Pseudomonas* is low and does not represent a significant carbon loss in experiments of several hours duration. Similarly, mixed heterotrophic populations provided with glucose, glycolate, and alanine showed negligible excretion up to 24 hours. After two days' incubation, however, *Pseudomonas* growing on glucose excreted 30% of the assimilated carbon in high molecular weights with indications that some of these may be polysaccharides; rates of polysaccharide production and excretion depend on the type of substrate and concentration as well as on various environmental factors. Direct excretion could not be experimentally distinguished from indirect formation by abiotic processes. It is likely that while low molecular weight algal and bacterial extracellular products are rapidly utilized by heterotrophs, large molecular weight compounds, by further complexing and binding, may grow to colloidal and particulate dimensions. (Auen-Wisconsin) W77-07996

CHANGES IN THE PROPERTIES OF E. COLI UNDER THE INFLUENCE OF WATER ENVIRONMENTS,

For primary bibliographic entry see Field 5A. W77-07997

BIOLOGICAL LONG-TERM INVESTIGATIONS OF SWEDISH LAKES,

T. Willen. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 1117-1124, 1975. 6 fig., 14 ref.

Descriptors: *Baseline studies, *Biological communities, *Indicators, Trophic level, Benthic fauna, Plankton, Chlorophyll, Data collections, Phosphorus, Nitrogen, Lakes. Identifiers: Lake Malaren(Sweden), Lake Vanern(Sweden), Lake Vattern(Sweden), Lake Hjalmar(Sweden), *Sweden.

Biological communities recorded between 1964 and 1974 in the Swedish Lakes Vanern, Vattern, Malaren and Hjalmar are compared to determine the degree of water quality improvement. The comparison was especially important in Lake Malaren, where after 1969 there had been a decreased input of nutrients, low water levels, higher Secchi disk transparency values and a tendency toward decreasing phytoplankton biomass. The abundance of oligochaetes, however, has increased. General water quality improvement has not bettered oxygen conditions in the hypolimnion, which may partially explain the oligochaete development; another factor is the alteration of influent water followed by longer residence time and increased sedimentation. Small changes in the species composition in Lake Vattern indicate a slow, gradual change from true oligotrophic conditions, but local industrial influences in the northern and southern parts have induced greater changes. Study of the bottom fauna in these lakes has yielded basic data and by analyzing some ecologically significant species it is possible to perform correlations and to specify the trophic level. (Auen-Wisconsin) W77-07998

PHOSPHORUS RELEASE FROM A HIGHLY EUTROPHIC LAKE SEDIMENT,

L. Bengtsson. Verhandlungen Internationale Vereinigung Limnologie, Vol. 19, Part II, p. 1107-1116, 1975. 5 fig., 4 tab., 16 ref.

Descriptors: *Phosphorus, *Lake sediments, *Cycling nutrients, *Eutrophication, Nutrient removal, Shallow water, Diversion, Nutrient requirements, Lakes. Identifiers: *Lake rehabilitation, *Lake Sodra Bergundasjön(Sweden), Phosphorus budget, Sewage diversion.

Sediment phosphorus release and its effect on the recovery of Lake Sodra Bergundasjön (Sweden) were investigated after sewage effluent diversion. Experimental results were based on mean release under anoxic conditions and no relationship was apparent between the concentrations of phosphate, iron, and manganese in the interstitial and bottom waters. Nor was there any apparent direct connection between the phosphate concentrations in the interstitial water and the phosphate release in the laboratory experiments, as the phosphate concentrations in the water at the termination of the experiments exceeded the interstitial water connections during sampling. The experimental results showed a high potential for anoxic phosphorus release from the sediments but of the same magnitude as the maximum value calculated from a mass balance of phosphorus for the lake. Due to the high phosphorus regeneration from the sediments, phosphorus will probably not become a limiting factor for the primary production in the near future although 97.5% of the phosphorus load has been diverted. (Auen-Wisconsin) W77-07999

STUDIES ON THE ROLE OF DETRITUS IN FRESH WATER LAKES,

Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst. L. S. Clesceri, C. W. Boylen, S. Kobayashi, and R. Park. FWI Report 76-9, October 1976, 29 p. 17 fig., 2 tab., 7 ref.

Descriptors: *Detritus, *Carbon, *Bottom sediments, *Biodegradation, *Degradation(Decomposition), Tributaries, Nitrogen, Phosphorus, Solubility, Polymers, Cellulose, Sorption, Pore water, Model studies, Cycling nutrients, *New York. Identifiers: Lake George(NY).

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Group 5C—Effects Of Pollution

The relative importance of detritus decomposition and allochthonous inputs in supplying carbon, nitrogen and phosphorus for the biomass, as well as the bio-degradability of the particulate organic matter from both sources were investigated in Lake George (New York) and two of its tributaries. Preliminary conclusions indicate that: (1) allochthonous dissolved organic carbon inputs from streams significantly exceed the particulate organic stream loadings; (2) organic polymer decomposition in sediment is mediated by temperature and agitation. Dependence on dissolved nutrient levels exists for brook delta sediments but not for littoral sediments; (3) the flocculent layer serves as a filter for nutrients initially through physicochemical mechanisms; (4) vertical distributions of nitrate anions, ammonia ions, phosphorus anions, and DNA occur in sediment cores and that their levels vary for different sediments; and (5) conversion of dead biological material to particulate organic matter takes place at varying rates characteristics of the source of the material. Mineralization occurring in the compacted sediment layers probably does not normally result in enrichment of the upper water column; the highly-sorptive flocculent layer probably acts as a barrier to the release of interstitial water nutrients, and the sorptive capability of the particles suspended in the water column. (Auen-Wisconsin)
W77-08001

CHEMICAL INTERACTIONS IN A EUTROPHIC LAKE,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
D. B. Aulenbach.
FWI Report 76-6, August 1976. 41 p. 16 fig., 4 tab., 18 ref.

Descriptors: *Eutrophication, Control, *Nutrient removal, Anaerobic conditions, Cyanophyta, Estimated costs, Chemcontrol, Mechanical control, Oxygenation, Silica, Dissolved oxygen, *New York, Runoff, Nuisance algae, Lakes.
Identifiers: *Lake restoration, *Saratoga Lake(NY).

Interrelationships among carbon dioxide, oxygen, light penetration, iron, phosphate, ammonia, nitrate nitrogen, silica and predominant algal forms were correlated with the presence or absence of oxygen and with biological productivity in eutrophic Saratoga Lake in eastern New York. The lake receives raw, partially and fully treated sewage effluents and agricultural runoff from the watershed and from an influent stream. The hypolimnion is devoid of oxygen during summer stratification and there is a marked oxygen deficiency below the 6 m level in the epilimnion on calm days. To reduce the trophic level, one proposed step was diversion of sewage effluents; however only 26% of the nitrogen and 17.5% of the phosphorus is contributed by the watershed's effluents and the influent creek contributes 1.36 mg/l of N and 0.3 mg/l P, thus diversion would not reduce these nutrient levels sufficiently to control the nuisance algae. Other alternatives considered were reaeration, phosphorus precipitation by chemicals and addition of silicon on the premise that diatoms would supplant the blue-green algae. Cost estimates of alum, lime, ferric chloride and sodium silicate were compiled, based on the present 116,000 kg P/yr input and projected loading of 95,300 kg P/yr after completion of the sewage treatment plant and effluent diversion. The least costly lake renovation approach would be an air reaeration system representing \$130,000 capital costs and \$11,000 for annual operation. (Auen-Wisconsin)
W77-08002

THE PROBLEM OF THE BEHAVIOR OF CHEMICAL POLLUTANTS IN THE ENVIRONMENT, (IN RUSSIAN),
For primary bibliographic entry see Field 5B.
W77-08028

INFLUENCE OF MUSSEL METABOLITES ON THE DYNAMICS OF NUTRIENTS IN THE COASTAL WATERS OF THE EASTERN MURMAN COAST, (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Institut (USSR).
A. N. Golovkin, G. P. Garkavaya, and I. V. Churbanova.
Okeanologiya 16(3), p 451-456, 1976.

Descriptors: *Phosphates, *Organic wastes, *Nutrients, *Phosphorus, *Nitrogen, Mussels, Surveys, Water chemistry, Water pollution, Coasts.
Identifiers: Metabolites, USSR, *Murmur Coast(USSR).

Hydrochemical surveys were made in the Porchnikha and Vysekovskaya (southern) USSR gubas (inlets) in July-Aug., 1971- and 1972, to determine the influence produced by the populations of East Murman mussels on the hydrochemical regime of the littoral zone. The highest phosphate, organic P and organic N concentrations were characteristic of the areas corresponding to the water level during the low tide or the initial phase of the high tide, i.e., places with the most dense mussel populations. Growth in NO₃ concentrations was not related to mussel grounds. A noticeable enrichment of water with phosphates at the initial phase of the high tide may originate from mussel metabolites accumulated during drainage in the mantle cavity as corroborated by calculations. The observations made in the 1972 mass mussel mortality showed that no growth in phosphate concentrations occurred at the initial phase of the high tide. Sharp changes in the content of nutrients in the coastal water may evidently be attributed to their isolation by mass organisms.-Copyright 1977, Biological Abstracts, Inc.
W77-08043

THE AVAILABILITY OF CHLOROPHYLLIDE IN HYDROPHYTES AND ALGAS OF LAKE TRASIMENO AND THE VARIABILITY OF PIGMENT CONTENT IN SPIROGYRA, (IN ITALIAN),
Perugia Univ. (Italy). Istituto di Orto Obot.
M. Antonioli, and M. R. Cagioti.
Riv. Idrobiol 14(1/2), p 3-12, 1975.

Descriptors: Algae, *Pigments, Lakes, Variability, Aquatic plants, *Chlorophyll, Water temperature, Light, Water pollution, *Aquatic algae.
Identifiers: Azolla-Filiculoides, Chara-Sp, *Chlorophyllide, Cladophora-Sp, *Hydrophytes, Lemna-Trisulca, Myriophyllum-Spicatum, Phragmites-Communis, Ranunculus-Aquaticilis, *Spirogyra, Spirogyra-Irregularis, Lake Trasimeno(Italy).

Large amounts of chlorophyllide were found in the following water plants; Spirogyra irregularis N., Cladophora sp., Chara sp., Azolla filiculoides, Myriophyllum spicatum, ranunculus aquaticilis, Lemna trisulca, Phragmites communis. The variability of pigments in Spirogyra during the last year was investigated and the highest chlorophyllide content in the wild types was found from March-May; at the same time the highest chlorophyll content was also found; the chlorophyll alpha/chlorophyllide ratio was near 4. With controlled conditions of temperature and light the highest content of green pigments was obtained in Spirogyra growing at 15 degrees C and 58.10-3 cal cm-2.m-1. This content decreased at 0 degrees C and lower light (9.7.10-3 cal cm-2.m-1); with the highest light at 22 degrees C the chlorophyll increased by the chlorophyll decreased and the chlorophyll alpha/chlorophyllide ratio approached 3.-Copyright 1977, Biological Abstracts, Inc.
W77-08044

5D. Waste Treatment Processes

WORKSHOP PROCEEDINGS - RESEARCH NEEDS RELATED TO RECYCLING URBAN WASTEWATER ON LAND,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 073, Price codes: A08 in paper copy, A01 in microfiche. Conference held June 19-21, 1974 in Harrisburg, Pennsylvania, Published June, 1974. 155 p. OWRT B-061-RI(1).

Descriptors: Water reuse, Recycling, Research priorities, *Sludge, *Waste water treatment, *Municipal wastes, Public health, Management, Legal aspects, Political aspects, Social aspects, Vegetation, Topography, Soils, Climates, Cities, *Waste water disposal, Institution, Environment.
Identifiers: *Land disposal, *Municipal wastewater.

A significant increase in land disposal of municipal wastewater and sludge has occurred recently in the U.S. However, concomitantly there is a lack of definitive data on parameters and constraints which must be considered in the design and operation of land disposal systems under varying environmental conditions. Therefore, a series of workshops attempted to summarize what is known about land disposal and what information is available, and to determine specific research needs as related to specific characteristics (climate, soils, geology, topography, vegetation). This workshop, sponsored by Northeast Water Center Directors, was held in Harrisburg, Pa., June 19-21, 1974. Workshop topics covered the following aspects: Social, political-legal-institutional, economic, biological and chemical, hydrological and physical, engineering and management, environmental and public health. The workshops and subsequent proceedings are intended to provide directives for future research in this area of critical importance. (Sink-Penn State)
W77-07607

EXAMINATION OF SEWAGE SLUDGE FOR ENTEROVIRUSES, VOLUME 2,
Ontario Ministry of Health, Toronto. Lab. Services Branch.
For primary bibliographic entry see Field 5B.
W77-07615

EXPERIENCE OF THE PAVLODAR OBLAST PUBLIC HEALTH SERVICE IN SANITARY PROTECTION OF THE IRTYSH RIVER, (IN RUSSIAN),
For primary bibliographic entry see Field 5G.
W77-07686

REVIEW OF COLOUR REMOVAL TECHNOLOGY IN THE PULP AND PAPER INDUSTRY,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
R. J. Rush, and E. E. Shannon.
-Economic and Technical Review Report EPS-3-WP-76-5, Environmental Protection Service, April, 1976, 113 p., 23 fig., 7 tab., 249 ref.

Descriptors: *Pulp and paper industry, *Waste water treatment, Effluents, Lignins, Aquatic environment, Land disposal, *Pulp wastes, Water pollution control, Color, Ozone, Reviews.
Identifiers: *Color removal, Effluent treatment system, Ozonation, Alum, Chemical treatment, Color control regulations.

--Developmental work on several processes for color reduction has reached full scale application and color removal is now required in many local areas. Color reduction can be achieved by either technical changes within the mill or by effluent

treatment systems. In-plant modification can range from simple, inexpensive measures such as pulp washing and better housekeeping practices, to complex technological changes such as implementation of oxygen bleaching. There are a large number of external treatment methods which are known to be technically feasible for color removal from pulp and paper mill effluents. Chemical treatment methods based on precipitation with Ca^{2+} , Mg^{2+} , Al^{3+} and Fe^{3+} have advanced to the stage of full scale application, as has the resin separation method of Uddeholm-Kamyr. The Rohm and Haas resin process, membrane processes (both ultrafiltration and reverse osmosis) and activated carbon adsorption have been tested on a large scale, while certain foam separation techniques, ozonation and extraction with amines have been examined on a smaller laboratory scale. These methods are known to be technically feasible, but the question of economics remain to be answered by further large and full scale testing. Several other methods have been and are being investigated. These include irradiation treatment, adsorption on fly ash and other waste materials, adsorption on activated alumina, land disposal, electrolysis and biological treatment. Color removal technology, although advancing rapidly, is still in its infancy. Many methods are known to work, but due to the wide range of effluents in the industry, no one method is likely to be applicable to all types. Therefore, research should continue to develop many viable alternatives for treatment. There is room for innovation in this aspect of wastewater treatment. (WATDOC)

W77-07734

UTILIZATION OF FLY ASH IN POLISHING OXIDATION POND EFFLUENTS, North Dakota Univ., Grand Forks. Engineering Experiment Station.

Y.-T. Hung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 307. Price codes: A05 in paper copy, A01 in microfiche. North Dakota Water Resources Research Center, Fargo. Research Report, W1-221-037-76, August 1976. 76 p, 5 fig, 40 tab, 8 ref. OWRT A-046-NDAK(1), 14-34-0001-6035.

Descriptors: *Oxidation lagoons effluents, *Tertiary treatment, Adsorption, *Fly ash, Filtration, *Organic wastes, Chemical oxygen demand, *North Dakota, Great Plains, Montana, *Waste water treatment.
Identifiers: Eastern North Dakota, Saskatchewan, Total organic carbon.

Sixteen fly ashes were investigated for their organic pollutant removal efficiency in the tertiary treatment of oxidation pond effluents in eastern North Dakota. The majority of fly ashes used were from the northcentral region including North Dakota, South Dakota, Montana and Saskatchewan. Both shaking runs (batch units) and filtration runs (continuous units) were employed. Mechanisms of organic removal by fly ashes were due to coagulation and adsorption by metallic oxides and also due to carbon adsorption. From batch tests it was found that increase in fly ash concentration resulted in an increase in TOC removal; sizes of fly ash and pretreatment of fly ashes employing washing of fly ashes did not have definite effect on the TOC removal for oxidation pond effluents. From continuous filtration tests it was shown that fly ash contained a high proportion of small particles which need to be removed before a reasonably high filtration rate can be attained. All filtration runs except the first run used those portions of fly ash with particle sizes larger than 0.0029 inches (U.S. sieve No. 200). Using a filtration rate of 0.0717 gpm/ft², which is commonly used in the slow sand filters, TOC removal by fly ashes was found to vary from 50 percent to 92.48 percent. Stratification of fly ash has effect on both the TOC removal and the filtration rate during the filtration study. The ungraded fly ash

has the highest TOC removal but the lowest filtration rate, while the fine at top to coarse at bottom stratification has the lowest TOC removal but the highest filtration rate. It was also found that TOC removal decreases as filtration rate increases. Filtration process appears to be a better process than batch process for TOC removal of oxidation pond effluents.

W77-07815

DISPOSAL OF FEEDLOT WASTES USING A TWO-STAGE PROCESS WITH NET ENERGY PRODUCTION, Kansas Water Resources Research Inst., Manhattan.

K. A. Bishop, and H. F. Rosson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 324. Price codes: A04 in paper copy, A01 in microfiche. Completion Report, KWRRI Contribution NO. 186, January 1977. 62 p, 10 fig, 17 tab, 18 ref, append. OWRT A-065-KAN(1), 14-31-0001-5016.

Descriptors: *Feed lots, Water pollution control, *Waste disposal, *Farm wastes, *Incineration, *Oxidation, Energy, *Byproducts, *Waste treatment, Effluents.
Identifiers: *Manure disposal, *Wet oxidation, Supplemental energy, Waste incineration.

Control of Water Pollution from feedlot operations continues to be a major problem. In certain cases, the choice of a disposal process which will result in a saleable by-product could partially or completely defray the expense of manure disposal. A process in which energy is the by-product is thermodynamically feasible; about half of the heating value of the manure can be recovered as useful thermal energy. A process was envisioned in which wet, undried feedlot manure would undergo a wet oxidation reaction followed by a second incineration step to complete the oxidation, with requisite heat exchange to recover thermal energy. In support of the wet oxidation step, experimental data on heating value, equilibrium oxidation, and kinetic rate were obtained. These data correspond reasonably well to literature values for domestic sewage sludge, the principal variation probably being due to particle size distribution. Because small particle size tends to favor rapid kinetics, control thereof should lead to lower pressure operation in smaller equipment, resulting in capital and operational economies. Because of the very dilute nature of the wet oxidation effluent and the low heating value of the contained solids, use of a second-stage incinerator was counterproductive to the overall system. (W77-07816)

HIGH GRADIENT MAGNETIC SEPARATION OF FOOD PROCESSING WASTEWATER, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Environmental Sciences and Engineering.

J. A. Petruska.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 440. Price codes: A06 in paper copy, A01 in microfiche. Master's thesis, March 1977. 92 p, 11 tab, 28 fig, 49 ref. OWRT A-065-VA(1).

Descriptors: *Waste water treatment, Liquid wastes, Industrial wastes, Turbidity, *Separation techniques, Phosphorus, Chemical oxygen demand, Organic wastes, Sampling, Activated carbon, Adsorption, *Food processing industry.
Identifiers: *Food processing, Waste treatment, *High gradient magnetic separation.

The amenability of food processing wastewater to treatment by High Gradient Magnetic Separation was studied. Initially, soluble organic removal by a combined use of activated carbon adsorption and HGMS was investigated. The studies with known concentrations of soluble starch revealed that although adsorption of the starch could be accom-

plished, the removal of the activated carbon in the magnetic separator was inefficient. At concentration levels of 3,000 mg/l and 6,000 mg/l, only approximately 70 percent of the activated carbon could be removed from the water slurry by HGMS. Actual composite wastewater samples collected from a food processing unit were treated by magnetic separation. Certain parameters such as color plus turbidity, chemical oxygen demand, total phosphorus, and solids were monitored to determine the effectiveness of the treatment. In most cases reductions in these parameters after magnetic treatment were noted. (W77-07852)

FACTORS AFFECTING NITRIFICATION, Engineering-Science, Inc., Atlanta, Ga. M. R. Hockenbury, G. T. Daigger, and C. P. L. Grady, Jr.

Journal of the Environmental Engineering Division-ASCE, Vol 103, No EE1, p 9-19, February, 1977. 1 fig, 3 tab, 13 ref.

Descriptors: *Nitrification, *Bacteria, *Organic matter, *Activated sludge, Domestic wastes, Industrial wastes, Dissolved oxygen, Growth rates, Aeration, Hydrogen ion concentration, *Waste water treatment.

Laboratory studies were conducted to investigate factors which affect nitrification. These included the effect of heterotrophic bacteria and organic compounds on nitrifying bacteria, and the possible adverse effects created by material released in waste water during treatment in a plug flow activated sludge aeration basin. Results indicated no effects by actively metabolizing heterotrophic bacteria upon nitrate production by autotrophic nitrifiers. Domestic sewage did not affect nitrate production by nitrifying bacteria when inhibitory industrial wastes were absent. No adverse effects from treatment in plug flow activated sludge aeration basins were found when suitable pH and dissolved oxygen levels were maintained for autotrophic nitrifiers. Heterotrophic bacteria released growth factors which slightly stimulated autotrophic nitrifier activity. Many inhibitory compounds in tested sewage were apparently degraded within the first half-hour of activated sludge treatment. (Collins-FIRL)

W77-07854

STUDIES ON ADSORPTION WITH ACTIVATED CARBON, Birmingham Univ. (England). Dept. of Civil Engineering.

T. H. Y. Tebbutt, and S. J. Bahiah.
Effluent and Water Treatment Journal, Vol 17, No 3, p 123-127, March, 1977. 7 fig, 1 tab, 5 ref.

Descriptors: *Adsorption, *Activated carbon, Analysis, Chemical oxygen demand, Chemical properties, Physical properties, Separation techniques, Water purification, Toxicity, Carbon, *Waste water treatment.

Adsorption studies using activated carbon were conducted to gather information on low organic concentrations in treated waste water and polluted raw waters. Factors involved in adsorption are surface tension, capillary condensation, chemical adsorption, and physical adsorption. Test results revealed that fatty acids and lipids were adsorbed more efficiently on activated carbon than carbohydrates. Amino acids were adsorbed to an even lower degree. There is a predictable increase in adsorbability with the increase in the molecular weight of a compound class. There is also a trend towards increased adsorbability with decreased solubility for a given compound class. Designing an efficient adsorption facility rests on a knowledge of water and waste water chemical composition, and on the use of parameters such as TOC or COD. Adsorption may not always be a suitable removal process since the adsorption behavior of organic compounds varies considerably. (Collins-FIRL)

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

W77-07855

BIOLOGICAL PHOSPHATE ELIMINATION OF PRELIMINARILY CLEANED COMMUNAL WASTE WATER BY USE OF IRON BACTERIA (BIOLOGISCHE ENTPHOSPHATUNG VORGEREINIGTEN KOMMUNALEN ABWASSERS UNTER MITWIRKUNG VON EISENBAKTERIEN),
G. Bringmann.
Zeitschrift fuer Wasser und Abwasser Forschung, Vol 9, No 6, p 195-196, 1976. 1 fig.

Descriptors: *Phosphates, *Biological treatment, *Oxidation, Microorganisms, Carbon dioxide, Iron, *Sewage treatment, Pilot plants, Treatment facilities, *Waste water treatment.

A report was presented of a model plant for the removal of biological phosphate from the phosphate-rich effluent of a sewage treatment plant after biological pretreatment. It was found that autotrophic microorganisms, gaining their chemoenergy from oxidation of $Fe(2+)$ to $Fe(3+)$ as they assimilated carbon dioxide, provided an effective means of phosphate removal. (Collins-FIRL)

W77-07856

PROCESS STABILITY OF ACTIVITY SLUDGE PROCESSES,
Pirmie (Malcom), Inc., White Plains, N.Y.
C. H. Chiang.

Journal of the Environmental Engineering Division-ASCE, Vol 103, No EE2, p 259-271, April, 1977. 3 fig, 3 tab, 2 append.

Descriptors: Model studies, *Stability, *Kinetics, *Mathematical models, *Activated sludge, Chemical properties, Physical properties, *Waste water treatment, Sludge treatment, Sewage effluents.
Identifiers: Retention times, Substrate concentrations.

Process stability indicators were developed and their importance considered for completely mixed activated sludge processes. Kinetic and mathematical models were used to determine the relationship of stability indicators. Process response and the transient concentration of soluble effluent substrate characterized process stability. Solids retention time and hydraulic detention time were found to be very important in the determination of process response. Transient soluble effluent substrate was found to be a function of solids retention time and influent substrate concentration. Hydraulic detention time in this case was unimportant. (Collins-FIRL)

W77-07857

CONCENTRATION OF BACTERIA IN WATER USING THE ULTRAFILTRATION METHOD, (IN FRENCH),
Institut National de la Sante et de la Recherche Medicale, Villeneuve D'Ascq (France). Ecotox. Microb. Unit.
P. A. Trinlet, and H. Leclerc.
Ann Microbiol (Paris) 127B(2); p 201-212, 1976.

Descriptors: *Bacteria, *E. coli, *Filtration, Separation techniques, *Waste water treatment, Water treatment.
Identifiers: *Ultrafiltration method.

The experiments with *Escherichia coli* allow the selection of an ultrafiltration apparatus which concentrates bacteria with high recovery efficiencies. The use of this concentrator is simple and fast. Its filtration power is very stable and its capacity allows the continuous ultrafiltration of large volumes of water.—Copyright 1977, Biological Abstracts, Inc.
W77-07860

ESTIMATING COSTS OF WASTE WATER SLUDGE DISPOSAL,
Boyle Engineering Corp., Orlando, Fla.
For primary bibliographic entry see Field 5E.
W77-07861

NITRIFICATION IN SOIL TREATED WITH DOMESTIC AND INDUSTRIAL SEWAGE SLUDGE,
Georgia Univ., Experiment. Dept. of Agronomy.
For primary bibliographic entry see Field 5E.
W77-07862

GERMAN POLLUTION CONTROL,
For primary bibliographic entry see Field 5G.
W77-07863

DIRECT AND INDIRECT WASTE WATER REUSE FOR MUNICIPAL PURPOSES,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
H. I. Shuval.
Ambio, Vol 6, No 1, p 63-65, 1977. 11 ref.

Descriptors: *Water reuse, *Water purification, Domestic water, Irrigation, *Municipal water, *Potable water, Pathogens, Toxicity, *Waste water treatment, Treatment facilities, Water quality control, Planning.
Identifiers: *Israel.

The reuse of waste water in Israel was discussed. It is hoped that eventually waste water will be reusable for unlimited domestic purposes, and that it will provide a source of potable water. Limited municipal uses now include firefighting, irrigation of parks and recreational areas, and street cleaning. Highly treated water can be used in public buildings, and in homes for toilet flushing. Even for these applications, purification would have to assure freedom from microbiological hazards. One problem is that there are inadequate standards for pollutants and contaminants in drinking water. Many bacterial pathogens are effectively countered by chlorination but others are resistant. There should be an established maximum allowable concentration or limit for each potentially hazardous chemical found in renovated waste water. Tolerance levels to known toxicants should also be established. If waste water is to be reused domestically, a full-scale epidemiological evaluation of such reuse should be conducted. Regardless of these problems, the reuse of waste water for agricultural, industrial, and non-potable municipal purposes should be considered until more complete answers to these questions are provided. (Collins-FIRL)

W77-07866

SILK FROM SOW'S EARS.
Engineering News-Record, Vol 198, No 15, p 52, April, 1977.

Descriptors: *Recycling, *Sludge treatment, *Waste disposal, Fuels, Metals, Treatment facilities, Planning, Costs, *Waste water treatment, Combustion.

Various projects being developed for refuse and sludge recycling were described. A solid waste and sludge recycling plant will be constructed in Wilmington, Delaware. The operation combines metal and gas recovery with a process to provide fuel for a powerplant and compost production. It will cost about \$30 million for the plant to process 1,000 tons/day of refuse and 50 tons/day of dry sludge. Another facility for Monroe County, New York, will process 2,000 tons/day of solid wastes at a cost of nearly \$20 million. An electric company in St. Louis dismissed a proposed facility because of difficulty in obtaining collection sites. Increased transportation costs, the inability of boilers to accept the material, and possible damage to boilers from waste combustion, eliminated Ten-

nessee Valley Authority plans to burn refuse from its fossil-fueled plants. Seattle, Washington, is considering a pyrolysis plant similar to the one in South Charleston, West Virginia, which is experimenting with sludge disposal. (Collins-FIRL)

W77-07867

SAVE SLUDGE HANDLING COSTS BY LEVEL CONTROL,
Markland Specialty Engineering, Ltd., Toronto (Ontario).
J. R. Tansony.
Modern Power and Engineering, Vol 71, No 3, p 34, March, 1977.

Descriptors: *Sludge treatment, *Costs, *Automatic controls, *Sludge disposal, Slurries, Suspended solids, Pumps, Treatment facilities, Flow, Performance, Equipment, *Waste water treatment.

Reductions can be made in sludge treatment and handling costs by the use of an automatic sludge level control. Significant savings result from the removal of excess water, which is nearly 90% of sludge composition. The process involves pumping sludge from clarifiers or settling tanks at the highest suspended solids level possible with the minimum of water possible. To institute automatic control, the optimum sludge blanket for each clarifier and/or settling tank must be known. The level should not be allowed to vary more than a few inches from this optimum. A sludge blanket detection probe is needed, and one has been developed which works on the principle of ultrasonic adsorption. This system operates accurately even in opaque slurries and resists fouling in slimy wastes. Pumping solids only on demand and maintaining an optimum sludge blanket level reduces the amount of gallons discharged from the sludge pump for added handling. Potential savings are high and equipment costs would be quickly repaid. (Collins-FIRL)

W77-07868

'HYDIG'-ONE EXAMPLE OF CONTROLLED SLUDGE USE,
For primary bibliographic entry see Field 5E.
W77-07871

WASTE WATER PLANTS USE LESS INSTRUMENTATION THAN RELATED INDUSTRIES,
Raytheon Co., Portsmouth, R.I.
A. E. Molvar, J. F. Roesler, R. H. Wise, and R. H. Babcock.
Water and Wastes Engineering, Vol. 14, No. 4, p 58, 60-61, April, 1977. 2 fig, 1 tab.

Descriptors: *Treatment facilities, Automation, *Instrumentation, Costs, Equipment, *Automatic control, Operations, Maintenance, *Water quality standards, Measurement, Computers, *Waste water treatment.

Waste water treatment plants were found to use less instruments and automatic controls than related water supply and chemical processing plants. The average secondary plant allocates about 3% of construction costs for installed instruments, although related industries allocate from 6 to 8% for this purpose. About 2% was allotted for remote satellite, wet-weather treatment plants. Only central, computerized, storm water-routing and in-line storage systems had an apparently adequate number of instruments and automatic controls. Reasons for this included the lack of a profit motive to produce high quality effluent; no legal penalties for low quality effluent and poor enforcement of effluent standards and guidelines; lack of commercially available, reliable instruments for process parameter measurement; oversized plant capacity that allows for less controlled operations; and a lack of familiarity with instrumentation practices and needs. Unreliable sensors were a major problem. They created more main-

tenance problems than their industrial counterparts. Successful controls were used for automatic liquid-level, liquid-flow rate, and air-flow rate control. Systems for controlling chemical addition, residual chlorine feedback, and digester temperature worked well. Computers were used for data acquisition in 20% of the facilities studied; only two facilities had process control computers. Storm water control with computer supervision was seen in three facilities. Research on and the development of reliable instruments was highly recommended. (Collins-FIRL)
W77-07872

FINANCING: THERE MUST BE A BETTER WAY.
Quad-City Solid Wastes Committee, Paterson, N.J.
For primary bibliographic entry see Field 5G.
W77-07873

WASTE WATER RECLAMATION IN ST. CROIX.
Black, Crow and Eidsness, Gainesville, Fla.
O. K. Buros.
Journal Water Pollution Control Federation, Vol. 49, No. 3, p 429-435, March, 1977. 5 fig, 2 tab, 3 ref.

Descriptors: *Groundwater recharge, *Groundwater resources, *Water reuse, Artificial recharge, Groundwater availability, Sewers, Water use, Water conservation, Treatment facilities, Desalination, *Virgin Islands.
Identifiers: *St. Croix (Virgin Islands).

A report was presented on waste water reclamation in St. Croix, U. S. Virgin Islands. The advent of tourism and industrial and economic development has greatly increased water demand on the island while depleting groundwater supplies. Various water reuse schemes have been investigated. Groundwater recharge received much attention in preventing deterioration of well field and augmenting water supplies. Interceptors and pumping stations are being constructed to deliver waste water to a central treatment plant. The quality, quantity, and movement of surface and groundwaters were studied intensely to determine placement of these facilities for the best advantage. The reclamation plant is a completely mixed, activated sludge plant with aeration tanks, clarifiers, solids removal by coagulation and flocculation with aluminum sulfate, filtration, and chlorination. Artificial recharge began in 1974 and studies indicated that expansion of the program was economical and technically feasible. The program is expensive, but much cheaper than the desalination programs which were tried. (Collins-FIRL)
W77-07875

SURVEY PREDICTS 33 PERCENT MUNICIPAL COMPLIANCE WITH 1977 DEADLINE.
For primary bibliographic entry see Field 5G.
W77-07877

1976 NEEDS SURVEY MARKEDLY LOWER.
For primary bibliographic entry see Field 5G.
W77-07878

TELESCOPING FORM SYSTEM SPEEDS SEWER CONCRETING.
For primary bibliographic entry see Field 8F.
W77-07879

GAS DETECTORS DETERMINE HEALTH HAZARDS IN SEWAGE TREATMENT.
For primary bibliographic entry see Field 5A.
W77-07880

HOW TO DETERMINE WASTE WATER FLOW.
For primary bibliographic entry see Field 5F.
W77-07881

A NEW VACUUM SEWAGE SYSTEM BY IFO WARTSILA.
Shipbuilding and Marine Engineering International, Vol 99, No 1204, p 684-686, December, 1976. 1 fig.

Descriptors: *Sewerage, Boats, *Sewage disposal, Storage, Piping, Pollution abatement, Pressure conduits, Plumbing, Economics, Waste disposal, Storage.
Identifiers: Vacuum pressure, Marine sanitation.

A new marine vacuum sewage system was introduced by Swedish firms. All sanitary fittings are connected to a piping system kept under partial vacuum pressure. This pressure is generated by pumps at the outlet end of the system. Sewage is pumped to a holding tank which can be emptied at port or directly into the sea in unrestricted waters. The holding tank need not be a vacuum tank and the vacuum system may be connected to any receptacle under atmospheric pressure by a special discharge unit. The holding tank can be designed to accommodate available space or an existing facility may be used. The components of the system are more expensive than a conventional system, but the freedom of pipe routing which benefits the sewage system and other ship sub-systems, along with the retrofit installation advantages, provide many cost reductions. Only 1.2 liters of water are used per flushing, and the toilet water can be separated from other waste water. This creates water savings and produces about 10 liters of sewage per person per day, as compared to 200-300 liters for conventional gravity flow systems. (Collins-FIRL)
W77-07882

INCREASING SEWER CAPACITY BY POLYMER DOSING.
Bristol Univ., (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8G.
W77-07883

STUDY OF IN-SERVICE BITUMINIZED FIBER SEWER PIPE.
University of South Florida, Tampa. Dept. of Structures, Materials, Fluids.
For primary bibliographic entry see Field 8G.
W77-07884

MOVEMENT JOINT FOR CONCRETE SEWER BRIDGE.
For primary bibliographic entry see Field 8F.
W77-07885

HANDLING SMALL AMOUNTS OF CRUDE SEWAGE.
For primary bibliographic entry see Field 8G.
W77-07886

PIPES FOR SEWERAGE AND SURFACE WATER.
For primary bibliographic entry see Field 8G.
W77-07887

THE CONCEPTION, DESIGN, AND CONSTRUCTION OF METROPOLITAN TORONTO MID-TORONTO SEWER.
Maclaren (James F.) Ltd., Willowdale (Ontario).
For primary bibliographic entry see Field 8B.
W77-07888

IMPROVEMENT AND EXPANSION OF THE DRAINAGE SYSTEM OF HAMBURG.
Abwassertechnische Vereinigung e. V., Bonn (West Germany).
E. Kuntze.
Journal Water Pollution Control Federation, Vol. 49, No. 3, p 499-502, March, 1977.

Descriptors: *Drainage systems, *Water quality control, *Public health, *Combined sewers, *Separated sewers, Urban drainage, Cities, Pollution abatement, Storm water, Treatment facilities, Overflows, Construction, Engineering structures, Waste water treatment.
Identifiers: *Hamburg (West Germany).

The City of Hamburg, West Germany, has embarked on a program to improve its drainage system. Deterioration of its waterways and the rapid growth following its devastation after World War II made improvements and expansion of drainage and water treatment systems necessary. The system was primarily a combined sewer system with separate sewers added to accommodate post-war expansion. Results of this construction, aided by geographical considerations, were increased loads of existing trunk sewers which led to frequent storm overflows, and sewers which were overloaded by the increased per capita water consumption. A study revealed that nearly 1,000 kilometers of the system were older than 50 years and needed renovation; 92% of the population was connected to the drainage system; most of the industrial firms were connected to the drainage system or had their own treatment facilities; treatment efficiency was between 50 and 94%; and about 75 million cubic meters of highly polluted storm water was discharged into smaller city streams and created extreme pollution. The proposed solutions involve stopping the direct disposal of untreated waste water into natural water resources; banning disposal of treated effluents into streams incapable of sufficient self-purification; reducing overflows from combined sewers and relocating storm overflows to more suitable areas; expanding treatment plants which discharge effluents into the Elbe; renovating the old central drainage system and improving its capacity; building new sewers in areas already built up, but not connected to the drainage system; and finding an economical treatment for storm water from separated systems before disposal. The city is applying model studies, electronic analysis, flow control investigations, and economic analysis in various investigations of the best means for solving these problems. (Collins-FIRL)
W77-07890

MARINE SANITATION METHOD AND DEVICE.
Filteron Systems Inc., Dallas, Tex. (Assignee).
G. H. Behrendt, and J. L. Potter.
United States Patent 4,009,104. Issued February 22, 1977. Official Gazette of the United States Patent Office, Vol. 955, No. 4, p 1264, February, 1977. 1 fig.

Descriptors: *Patents, Equipment, Sewage treatment, Saline water, Sanitary engineering, *Waste water treatment, Electrolysis, Water purification, Storage.
Identifiers: Marine sanitation.

A patent was issued for an automatic marine sanitation unit and sanitation method. The system incorporates two storage tanks, a sewage inlet to the first tank, and a separator for solids beyond a determined size limit. A means is provided for the circulation of salt water containing sewage from the first to the second tank while the first tank is filling. The effluent passes through an electrolytic cell during this transfer. A portion of treated effluent is returned to the first tank. (Collins-FIRL)
W77-07891

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

COAL DISTN. WASTE LIQUOR PURIFICN. TO REMOVE PHENOLS, AMMONIA- AND HYDROGEN SULPHIDE BY 2-STAGE SOLVENT EXTN. AND DISTN.,
South African Patent ZA 7600-011. Issued November 11, 1976. Derwent French Patents Abstracts, Vol. Y, No. 4, p D4, March, 1977.

Descriptors: *Patents, *Separation techniques, *Phenols, *Ammonia, *Hydrogen sulfide, Distillation, Liquid wastes, Sewage treatment, *Waste water treatment, Treatment.

A patent was issued for a method to remove monohydric and polyhydric phenols, hydrogen sulfide, and free and combined ammonia from sewage by extracting and distilling waste water formed during degasification or gasification of coal with subsequent biological purification. Most of the monohydric phenol, part of the polyhydric phenols, and any free fatty acids present are separated by extraction. Phenols are separated by distillation. Next, a major portion of the polyhydric phenols is separated and the remainder of the monohydric phenols and free fatty acids are separated by extraction with an organic solvent. Phenols in this extract are changed to their salts which are then washed. This mixture is separated into an organic and aqueous phase. The organic phase is recycled, and free phenols are separated from the aqueous phase by surplus CO₂ and by decanting and/or extraction with the organic solvent or the sump product. (Collins-FIRL)
W77-07892

OXYGEN ADDN. REGULATION IN WATER AND SEWAGE PURIFICN.—USING EJECTORS TO SECURE INTIMATE CONTACT WITH ACTIVATED SLUDGE,
Belgian Patent BE 845-103. Issued February 14, 1977. Derwent French Patents Abstracts, Vol. Y, No. 6, p J3, March, 1977.

Descriptors: *Patents, *Oxygenation, Treatment facilities, Oxygen, Sludge treatment, Sewage treatment, Activated sludge, Water purification, Dissolved oxygen, Gases, *Waste water treatment.

A patent was issued for oxygen addition regulation in water and sewage purification. The process is designed for plants with at least one treatment unit mounted in cascade. A gas with a 20-45% volume of oxygen is introduced in the finely divided state to produce a great agitation of the waste water. Two units in cascade are fed with water from the inlet on the suction side of the pump which also recycles partially purified water containing activated sludge. This mixture is pumped through an ejector to meet the recycled gas from a compressor. Activated sludge from the settlement tank has a flocculant structure and goes into suspension in the liquid in the first unit. Technical oxygen is introduced in a quantity dependent upon the content of biodegradable materials in the water. Oxygen in the first unit water is maintained at 1-4 milligrams/liter. A rapid transfer of oxygen to the liquid and of dissolved oxygen in the liquid to the finely divided activated sludge is assured. The amount of dissolved oxygen can be maintained at a constant value despite variations in the rate of the raw water supply. (Collins-FIRL)
W77-07893

FLOTATION TREATMENT OF WASTE WATER AND SEWAGE-USING GAS CONTG. OXYGEN IN DEEP PIT TO FLOAT THE PARTICLES,
French Patent FR 2306-745. Issued December 10, 1977. Derwent French Patents Abstracts, Vol. Y, No. 6, p J3, March, 1977.

Descriptors: *Patents, *Separation techniques, *Flotation, Equipment, *Waste water treatment, Sewage treatment, Sludge treatment, Air, Gases, Oxygen.

A patent was issued for the flotation treatment of waste water and sewage. The device is composed of a tank with a pit beneath it which contains rising and descending passages separated by a partition. These passages are connected above and below the partition. The upper passage extends above the tank base and contains a means for directing flow. The rising passage opens in a flotation chamber near a separator, and the upper end of the chamber opens in a flotation tank. Gas containing oxygen is injected into the two passages. The bubbles of the gas are injected into the descent passage and move down to where the pressure is greatest and their size is reduced. Most of the bubbles are completely absorbed by the water at the lowest levels. When the water rises, the bubbles reappear and grow. Air bubbles attach to the particles which pass through the opening into the flotation chamber, and raise the solids to the surface where they are raked off and evacuated. Substantial sludge recycling is possible without sedimentation, thereby avoiding long anaerobic tank treatment. Special compression chambers or decompression systems are not necessary to achieve flotation. (Collins-FIRL)
W77-07894

MACERATOR-STERILIZER SEWAGE TREATMENT SYSTEM,
General American Transportation Corp., Chicago, Ill. (Assignee).
P. A. Saigh, and A. J. Glueckert.
United States Patent 4,012,322. Issued March 15, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 3, p 958-959, March, 1977. 1 fig.

Descriptors: *Patents, *Domestic wastes, *Liquid wastes, *Sewage treatment, Automatic controls, Temperature, Heat treatment, Equipment, Sewage effluents, *Waste water treatment. Identifiers: *Sterilization.

A patent was issued for a sterilizer sewage treatment system which collects, treats, and discharges toilet wastes. The system is composed of a collection tank, a sterilization tank and a transfer pump which is connected to the collection tank and to the sterilization tank by a power-operated valve transfer mechanism. Liquid sewage is measured into the sterilization tank where the temperature is elevated to a preset level. Automatic controls and sensors operate the valves, pumping, and heating mechanisms to control effluent flow. (Collins-FIRL)
W77-07895

SEWAGE TREATMENT APPARATUS,
Sloan Valve Co., Franklin Park, Ill. (Assignee).
J. D. Snodgrass, and J. J. Pilolla.
United States Patent 4,013,557. Issued March 22, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 4, p 1379, March, 1977. 1 fig.

Descriptors: *Patents, *Electrolysis, *Electrodes, Equipment, Water purification, *Waste water treatment, Liquid wastes, Waste treatment, Treatment facilities, Mechanical engineering, *Sewage treatment.

A patent was issued for an apparatus providing for the electrolytic treatment of sewage. This treatment occurs in a casing with electrodes positioned between the casing inlet and a valve adjacent to the discharge outlet. A fluid is introduced to this treatment zone to provide agitation and turbulence which produces a homogeneous sewage liquid. Projections above the treatment area, and adjacent to the electrodes aid sewage reduction. (Collins-FIRL)
W77-07896

CONTROL OF AEROBIC BIOLOGICAL GROWTH IN ACTIVATED CARBON WASTE TREATMENT,
Australian Patent 480,396. Issued June 25, 1973. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol. 47, No. 5, p 382, February 17, 1977.

Descriptors: *Patents, *Activated carbon, Suspended solids, Organic matter, Filtration, Oxygen, Chemical oxygen demand, *Waste water treatment, Water purification, Pollution abatement.

A patent was issued for a process to remove suspended and dissolved organic matter from waste water. The waste water is pretreated for removal of suspended matter and passed through at least one activated carbon bed to remove dissolved contaminants. Oxygen is added to the bed at a rate of 0.09-0.15 pounds per pound of COD contaminants removed. (Collins-FIRL)
W77-07897

AUTOTHERMAL AEROBIC DIGESTION,
Union Carbide Corp., Tonawanda, N.Y.
L. C. Matsch, and R. F. Drnevich.
Journal Water Pollution Control Federation, Vol. 49, No. 2, p 296-310, February, 1977. 3 fig, 10 tab, 7 ref.

Descriptors: *Aerobic treatment, *Sludge digestion, Temperature, Oxygen, Design criteria, Metabolism, Laboratory tests, Physical characteristics, Chemical characteristics, Waste water treatment, Nutrients. Identifiers: *Aerobic digestion.

Union Carbide has studied aerobic digestion systems using high purity oxygen since 1972. Aerobic digestion at temperatures greater than 45°C produces a sludge which is practically pathogen-free and more suitable for land or ocean disposal. A high degree of digestion at a residence time of 5 days or less can be obtained at this temperature. Reducing vaporization losses allows the oxygen to utilize the exothermal nature of endogenous metabolism and maintain the temperature above ambient. Autothermal thermophilic aerobic digestion (ATD) is self-regulating due to a decrease in the digestion rate when temperature rises above 60°C and the system inhibits nitrification to decrease oxygen requirements. The process is very stable and recovers from extreme equipment malfunctions and operator errors within hours of correction of the problem. The sludge from this system dewateres as well as anaerobically digested sludge. A higher degree of digestion at the same retention time, an improved oxygen use and no pathogen leakage are advantages of the two-stage thermophilic digestion system over the single stage system. Defining 'stable sludge' from an aerobic digestion system was also a part of the investigation. Different degrees of stability are required depending upon the means of ultimate disposal. The ATAD process was found to be less costly than a mesophilic system because of small reactor volumes, lower oxygen requirements, less energy requirements, and the production of a pathogen-free sludge. (Collins-FIRL)
W77-07898

EXPERIENCES IN EVALUATING AND SPECIFYING AERATION EQUIPMENT,
Black and Veatch, Kansas City, Mo.
J. R. Stukenberg, V. N. Wahbeh, and R. E. McKinney.
Journal Water Pollution Control Federation, Vol. 49, No. 1, p 66-82, January, 1977. 13 fig, 7 tab, 18 ref.

Descriptors: *Aeration, Equipment, *Activated sludge, Theoretical analysis, Oxygen demand, Performance, Design criteria, Testing, Evaluation, Sludge treatment, *Waste water treatment.

The advancement of testing methods and knowledge of aeration theory have allowed the proper application and evaluation of aeration equipment. Testing of aeration equipment is important, even though it adds to installation costs, because performance cannot be accurately predicted. Criteria for choosing equipment should include: oxygen requirements, maximum power use allowable, turndown requirements, mixing, noise, mist or spray, allowable power variation, and method of testing. The steady state and non-steady state aeration equipment tests are valid, although they do contain problems. Problems with the steady state test are the determination of the rate of O₂ uptake by activated sludge and of the O₂ transfer coefficient, and the correct values of DO saturation and of the DO residual. Problems with the non-steady state test are the values of DO saturation used for the determination of the O₂ transfer rate coefficient and possible cobalt interference on the Winkler DO analysis. Direct analysis of test data is valid as a supplement to conventional methods of determining O₂ transfer rate coefficients. (Collins-FIRL)

W77-07899

INTERMITTENT SAND FILTRATION FOR UPGRADING WASTE STABILIZATION POND EFFLUENTS,

Utah Water Research Lab., Logan.

S. E. Harris, J. H. Reynolds, D. W. Hill, D. S.

Filip, and E. J. Middlebrooks.

Journal Water Pollution Control Federation, Vol 49, No 1, p 83-102, January, 1977. 12 fig, 9 tab, 7 ref, 1 append.

Descriptors: *Filtration, *Soil filters, *Filters, *Oxidation lagoons, Performance, Economics, Suspended solids, Phosphorus, Nitrification, Temperature, Costs, *Waste water treatment, Water purification, Sewage effluents.

Identifiers: *Sand filtration.

A simple, economical, low maintenance treatment method was found necessary for polishing lagoon effluent to meet the requirements of PL 92-500. The need was especially urgent because many communities with a population of less than 5,000 use stabilization ponds for economical waste water treatment and lack operators and maintenance crews having a high degree of technical knowledge. Research indicated that intermittent sand filters might economically satisfy the demands of this legislation. The length of filter run was found to be related to the influent suspended solids concentration and the hydraulic loading rate, as well as to algal growth in the standing water above the filter. These filters can produce an effluent with a BOD of less than 100 milligrams/liter and a suspended solids concentration of less than 10 milligrams/liter, as well as a volatile suspended solids concentration of less than 5 milligrams/liter. Winter effluent quality was slightly lower than warm weather effluent quality, but winter operation created no serious problems. Optimum single stage intermittent sand filter hydraulic loadings were about 0.4 to 0.6 million gallons/acre/day. (Collins-FIRL)

W77-07900

BRISTOL REGIONAL SEWAGE TREATMENT WORKS—PAST, PRESENT AND FUTURE,

Wessex Water Authority, Bristol (England).

Development and Planning Div.

P. H. Steel.

Chartered Municipal Engineer, Vol 104, No 1, p 5-

12, January, 1977. 10 fig, 1 tab, 4 ref.

Descriptors: *Treatment facilities, *Planning, Water purification, Water quality control, Waste identification, Waste disposal, *Waste water treatment, Water districts, Sanitary engineering, Sewage treatment, Sewage disposal, Drainage, Costs, Design, Comprehensive planning.

Identifiers: Bristol Regional Sewage Treatment Works(England).

A review of past, present, and future sewage treatment in the Bristol, England, area was presented. Proposals and actual treatment plans from 1879 to the present were first explored. The present system contains a system of main sewers which intercept old outfalls into the River Avon and provide adequate trunk sewers for the area; pumping stations which raise sewage from low-lying areas into the trunk sewer system; a main inverted siphon under the River Avon to carry sewage from south of the city to the north of the river; a main pumping station to pump sewage from the main trunk sewer to the treatment facilities; and a treatment works which handles a dry flow of 21 mgd. Partial treatment includes comminution or screening, grit removal, sedimentation and sludge digestion and secondary treatment to provide water for industrial purposes. Also included in the system is an effluent outfall on the bank of the River Severn. The advantages and disadvantages of phased development were discussed. Future proposals include modifications of the main pumping station, storm sewage treatment, sedimentation tanks, sludge thickening, regional sludge disposal, sludge digestion, added generating stations, industrial water treatment, and a tidal pumping station. These proposed additions and alterations would provide an ultimate capacity flow of 100 mgd and a hydraulic capacity of 1,520,000 cubic meters/day for the main pumping station. (Collins-FIRL)

W77-07901

EVALUATION OF ALTERNATE SOLIDS HANDLING METHODS FOR ADVANCED WASTE TREATMENT,

Flood and Associates, Inc., Jacksonville, Fla.

B. A. Bell, and T. M. Zaferatos.

Journal Water Pollution Control Federation, Vol 49, No 1, p 146-155, January, 1977. 4 fig, 8 tab, 10 ref.

Descriptors: *Solid wastes, *Solids contact processes, *Tertiary treatment, Sludge treatment, Operating costs, Capital costs, Sludge disposal, Chemical treatment, Evaluation, Performance, *Waste water treatment.

Various methods for handling solids in advanced waste treatment were explored. Eight systems considered included: single-stage recarbonation with disposal of dewatered sludge in landfill; single-stage recarbonation, dewatering, and incineration; single-stage recarbonation, recalcination of dewatered sludge, air classification, and lime recycle; single-stage recarbonation, wet centrifugal classification, recalcination of dewatered sludge, air classification, and lime recycle; two-stage recarbonation, dewatered sludge recalcination, air classification, wet centrifugal classification, dewatered recalcination and lime recycle; two-stage recarbonation, wet centrifugal classification, dewatered sludge recalcination, air classification and lime recycle. Each was considered as to equipment sizing and capital and operating costs. The solids material balance must be determined for proper sizing and economic comparison; wet centrifugal classification of sludge is economical for most municipal waste waters. Two-stage recarbonation with intermediate settling was thought to be economical for many municipal waste waters, although prior piloting of two-stage recarbonation is recommended before design. Waste water hardness and alkalinity, cost and availability of ultimate disposal, and quality and quantity of sludge from two-stage recarbonation greatly affect the economics of lime recalcination and recovery. (Collins-FIRL)

W77-07902

SURVEY OF ANAEROBIC DIGESTION SUPERNATANT TREATMENT ALTERNATIVES,

N. A. Mignone.

Water and Sewage Works, Vol 124, No 1, p 42-44,

January, 1977. 5 tab, 31 ref.

Descriptors: *Sludge digestion, *Anaerobic digestion, Sludge treatment, Activated carbon, Sludge disposal, Oxidation, Biological treatment, Fertilizers, *Waste water treatment, Sewage treatment.

Identifiers: Air stripping, Kraus system, Gas mixing, Sand beds.

Several options for the treatment of anaerobic digestion supernatant were explored. Intermittent mixing was considered and outperformed continuous mixing, which seemed to result in poor bio-flocculation and inefficient solids-liquid separation. Vacuum degasification increased the quality of sludge settleability and did not have the odor and foaming problems associated with air stripping. Activated carbon treatment is supposed to increase gas production and methane content, reduce odors, increase draining, and improve supernatant quality. Returning untreated supernatant to the treatment influent can cause increases in BOD₅, in dissolved and suspended solids, and in nutrients in the effluents. Supernatant disposal to sand beds is considered a solution only for very small plants. Air stripping or oxidation has mixed results, probably because the nitrification demand of supernatant liquid is more important than the carbonaceous demand. The Kraus system uses supernatant to increase organic loading on aeration tanks, provides biological process stability with variable influent flow and organic inputs, provides a ready supply of excess oxygen, and is a means for immediate plant recovery from system upsets. Phosphate could be removed from supernatant in a form suitable as fertilizer or the supernatant could be used as a growth accelerator for fish. Elutriation reduces chemical conditioning cost and improves compaction, but the loss of solids in the elutriate is considered undesirable. (Collins-FIRL)

W77-07903

PROCESS COULD SAVE MILLIONS OF POUNDS ON SEWAGE TREATMENT PLANTS,

Water Services, Vol 80, No 970, p 740, 742,

December, 1976.

Descriptors: *Adsorption, *Separation techniques, Flocculation, Suspended solids, Water purification, Organic matter, Odor, Sedimentation, *Activated carbon, Disinfection, *Waste water treatment, Costs, Potable water, Sewage treatment, Polymers.

Identifiers: *Polysorb Process.

The Polysorb Process, developed by Chemviron, may reduce construction costs of British treatment plants. The process employs polymers and granular activated carbon in a two-step physical/chemical program. It is economical, more quickly installed, and requires 85% less land than conventional biological treatment systems. The system produces no secondary effluent, removes more than 90% of most organic matter, and eliminates odor. The first stage removes suspended solids and the second removes dissolved organics. After disinfection the effluent can be directly discharged into lakes and streams or used for recreational, agricultural, or wildlife management purposes. Granular activated carbon can also be used to remove objectionable taste and odor from potable water. Estimates suggest that about one billion gallons of water/day could be saved by industry if activated carbon filters were used instead of sand, allowing nearly indefinite recycling of water within a plant. Many millions of pounds could be saved in the construction and operating costs of plants using this process. (Collins-FIRL)

W77-07904

SLUDGE DEWATERING BY BELT FILTER,

Water Services, Vol. No. 80, No. 970, p 742, December, 1976.

Descriptors: *Dewatering, *Filters, *Sludge treatment, Equipment, Domestic wastes, Industrial

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

wastes, Operating costs, Polyelectrolytes, Suspended solids, Flocculation, Chemical properties, Physical properties, *Waste water treatment. Identifiers: *Belt filters.

The Roediger SSP (straining, suction and pressure zones) belt filter, marketed in Britain, uses gravity draining and vacuum dewatering stages before the belt press and milling zones, where final moisture removal is conducted. The belt filter can be used with domestic and industrial waste sludge and the design reduces operating costs by requiring a minimum of flocculant. The stages of the process ensure a high solids capture as compared to conventional belt presses. A sludge cake with high solids content is produced, minimizing reconstitution during storage and facilitating handling. The sludge is mixed with polyelectrolytes in a rotating drum, and is passed over a straining zone allowing water to run through the filter belt media into a collection system. It continues through a suction zone where low vacuum ensures a filtrate slightly contaminated by fine suspended solids, necessitating only sludge flocculation, and then is pressed. The reduced flocculation requirement produces substantial cost savings. Normal final solids content is 35-40% from digested sludge, up to 35% from primary sludge, and up to 30% from aerobically stabilized sludge. (Collins-FIRL) W77-07905

HYGENIC ASSESSMENT OF TERTIARY ADSORPTION TREATMENT OF DOMESTIC SEWAGE AND INDUSTRIAL EFFLUENTS (GIGENICHESKAYA OTSENKA TRETICHNOYI ADSORBTSIONNOYI OCHISTKI BYTOVYKH I PROMYSHLENNIKH STOCHNYKH VOD).
E. I. Boncharuk, A. M. Koganovsky, V. N. Girin, and O. V. Salata.
Gigiena Sanitariya, No. 11, p 36-39, 1976. 2 fig, 2 tab, 2 ref.

Descriptors: *Adsorption, *Tertiary treatment, Domestic wastes, Industrial wastes, Ion exchange, Organic matter, Pathogens, Microorganisms, Water reuse, Water purification, *Waste water treatment.

A hygienic evaluation of a combined adsorption/ion exchange tertiary treatment system was conducted. A mixture of domestic and industrial sewage effluents was tested. Results showed a substantial removal of organic matter, pathogenic microorganisms, and bacterial pollution indicators. The treated effluent could be used as recirculated water. (Collins-FIRL) W77-07906

TWO-STAGE FILTRATION OF SECONDARY EFFLUENT,
General Filter Co., Ames, Iowa.
C. D. Biskner, and J. C. Young.
Journal Water Pollution Control Federation, Vol. 49, No. 2, p 319-331, February, 1977. 14 fig, 3 tab, 10 ref.

Descriptors: *Filters, *Suspended solids, *Trickling filters, Filtration, *Waste water treatment, Sewage effluents, Evaluation, Water purification, Treatment, Equipment.
Identifiers: *Two-stage filter systems.

A study was used to evaluate a two-stage filter system for suspended solids removal from the effluent of a trickling filter plant. The two-stage filtration of secondary effluent suspended solids concentrations equal to that of dual-media filters operating at similar average loading rates. More frequent backwashing of the first-stage filter allows the increase of filter runs and the reduction of backwash water volumes. The main advantage of the two-stage filtration system is its flexibility, allowing a broader range of media size combinations, and thus the use of granular media filters for treating effluents high in large-size suspended

solids particles. However, the size of the first-stage media is very important. Only a small fraction of solids load passes to the second-stage if it is too small, and if it is too large, excess amounts are passed to the second-stage. It was found that single-media filtration with simultaneous air-water wash was promising in the elimination of many problems associated with conventional backwash procedures. (Collins-FIRL) W77-07907

A SECOND LOOK AT WATER REUSE,
Hawaii Univ., Honolulu. Dept. of Civil Engineering.
G. L. Dugan, and P. H. McGauhey.
Journal Water Pollution Control Federation, Vol. 49, No. 2, p 195-205, February, 1977. 2 fig, 16 ref.

Descriptors: *Water reuse, *Irrigation, *Reservoirs, *Outfalls, Water purification, *Waste water treatment, Oxygen demand, Eutrophication, Nitrogen, Phosphorus, Suspended solids, Coastal areas, Tertiary treatment.
Identifiers: Oahu(HI), Indian Creek Reservoir(CA).

A review of factors involved in the reuse of water was presented. Data and conclusions were drawn from experience involving a five-year investigation of the Indian Creek Reservoir, California, a three and one-half year waste water irrigation project in Oahu, Hawaii, and other related activities and projects at the Sand Island Outfall and Kaneohe Bay, Oahu. The waste water treatment plant at Kaneohe Bay was completed in the early 1950's to cope with cesspool wastes and secondary effluent which was discharged into the Bay. This disturbed natural erosion-resisting properties of the soil and vegetative covering and increased the quantity of nutrients and sediments in the Bay. Sand Island has had much more experience; proposals to improve conditions in the area involve protecting fresh waters from high oxygen-demanding wastes, upgrading treatment plants, and protecting waters from increased eutrophication by reducing nitrogen and phosphorus concentrations to remove oxygen-demanding materials. These materials, suspended solids, and other chemical concentrations are relatively unimportant in deep coastal waters and a variance to secondary treatment regulations is requested so Hawaii can reduce the financial burden of facilities where advanced primary treatment is adequate. It was noted that effluent standards are much easier to regulate than receiving water standards. The California reservoir project demonstrated the feasibility of using reservoirs and improved tertiary treatment in combination to provide waste water of a quality suitable for reuse. The goal of all the studies was to hasten improvement of receiving water quality by improving the sophistication of waste water treatment processes. (Collins-FIRL) W77-07908

AUTOMATIC ANALYSIS CONTRIBUTES TO WASTE WATER TREATMENT EFFICIENCY,
For primary bibliographic entry see Field 5A.
W77-07909

AIR V. OXYGEN IN DORSET,
Water and Waste Treatment, Vol. 20, No. 1, p 14-15, January, 1977. 1 fig, 1 tab.

Descriptors: *Oxygen, *Oxygenation, *Activated sludge, Air, Aeration, *Treatment facilities, Filtration, Design, Automatic control, Equipment, Nitrogen, Sludge treatment, *Waste water treatment, Municipal wastes.
Identifiers: UNOX.

A preliminary evaluation was made of Europe's first municipal treatment plant which uses an oxygen activated sludge (UNOX) system. The plant

at Dorset, England, has installed the system as an extension of existing facilities. It is a two-stage activated sludge system using oxygen in the first stage and air in the second. Surface aeration is employed in both stages. Conventional biological filtration is used with recirculation and the extension forms a separate parallel works with possible linkage to existing filters after the first stage tanks. Nitrification can be achieved by either filtration or second stage treatment. Flexibility is a design feature. Operation can be divided into two identical halves to treat one stream as a control and the other stream as a variation outside of the normal design limits. The plant can be operated in an automatic mode. In the oxygen stage, the gas space above water level is pressurized with high purity oxygen. Conventional mechanical aerators produce oxygenation. Air is compressed, cooled, dewatered, and passed into one of the beds of molecular sieve material where nitrogen is adsorbed. Three beds are used in sequence to maintain oxygen flow while the sieve material is regenerated. Claimed benefits of the system are lower capital costs, less required space, and lower sludge production. (Collins-FIRL) W77-07910

POLY ALUMINUM CHLORIDE IN SLUDGE TREATMENT,
Water Services, Vol. 80, No. 970, p 748-749, December, 1976. 2 tab.

Descriptors: *Flocculation, *Sludge treatment, Chemical properties, Laboratory tests, On-site tests, Physical properties, Performance, Costs, Polyelectrolytes, Dewatering, *Waste water treatment.
Identifiers: *Poly aluminum chloride.

Poly aluminum chloride (PAC) has been recently marketed as a sludge conditioner. PAC is an aluminum hydroxy chloride of complex structure. Its controlled sulfate component ensures optimum coagulant performance and stability and it has a higher molecular weight than usual for inorganic flocculants. Its primary advantage is the floc structure it produces. These are larger and stronger, and form more rapidly than those of other inorganic coagulants. They also reform readily after disintegration. PAC is especially effective when used on sludges prior to dewatering on filter presses and rotary vacuum filters as an alternative to polyelectrolytes, iron compounds and lime or, in some cases, aluminum chlorohydrate. PAC is marketed as a liquid with 10% w/w Al₂O₃, and can be used without extensive systems modifications, such as those needed for the use of polymers. The product can also be used as a primary coagulant in potable water treatment and there are many industrial effluents it can effectively treat. (Collins-FIRL) W77-07912

MULTI-STAGE FILTER PRESS.
Water Services, Vol. 80, No. 970, p 744, 747, December, 1976. 1 fig.

Descriptors: *Filters, *Dewatering, Sludge, Industrial wastes, Potable water, Equipment, Performance, *Waste water treatment, Sludge treatment, Organic matter, Inorganic compounds.
Identifiers: *Multi-stage filter press.

A multi-stage filter press for dewatering both organic and inorganic sludges from industrial wastes and sewage was considered. Sludge, mixed with a flocculating agent, is fed into polyester mesh pockets where initial dewatering occurs, and is then discharged onto the first of two continuous belts of finer mesh which move horizontally in the opposite direction for additional drainage. Afterwards, the sludge is caught between this and another belt, forming two wedges, to consolidate and reduce it into a homogeneous mass. After passing through a series of six rollers, high pressure is applied for final dewatering. Performance

is good. After gravity dewatering, volume is reduced by 80% and dry solids by 15%; after medium pressure and high pressure dewatering, reductions are 90 and 92% for volume, and 32 and 40% for dry solids. Filtrate and wash water fall into troughs and drain to a concrete sump for return to primary settling tanks, or the equivalent, for treatment. (Collins-FIRL)
W77-07914

PHOSPHORUS IS REMOVED AT LOW COST,

Williams and Works, Grand Rapids, Mich.
T. C. Williams.
Water and Wastes Engineering, Vol. 13, No. 11, p 52-54, 63, November, 1976. 1 fig, 2 tab.

Descriptors: *Phosphorus, Chemical wastes, *Polymers, Treatment facilities, Costs, Operation, Maintenance, Biological treatment, Design criteria, *Waste water treatment.
Identifiers: Alma(MI), *Chemical treatment.

Low cost phosphorus removal was achieved in Alma, Michigan, by a treatment process involving extended aeration, chemical precipitation using ferric chloride and a polymer, and chemical oxidation of sludge. The design of this new waste water treatment plant was influenced by the small size of the community, requiring relatively low operation and maintenance costs; and by site restrictions such as a nearby residential development, necessitating an odor-free system. Other factors relating to the design were the high sewer infiltration rate, and the periodic discharge of concentrated toxic materials from a metal finishing plant. The effluent produced by the plant was well within the discharge limits, even when flow was as much as 50% over design. (Collins-FIRL)
W77-07915

BIOCHEMICAL AND PHYSICAL-CHEMICAL TREATMENT OF WEAK MUNICIPAL WASTE WATER,

Nova Scotia Technical Coll., Halifax. Dept. of Civil Engineering.
D. Thirumurthi, and J. R. Orlando.
Journal Water Pollution Control Federation, Vol. 48, No. 2, p 2708-2722, December, 1976. 4 fig, 7 tab, 14 ref, 1 append.

Descriptors: *Biological treatment, Chemical wastes, Biological properties, Chemical properties, Physical properties, Microorganisms, Temperature, Hydrogen ion concentration, Lime, Phosphate, Growth rates, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, *Waste water treatment.
Identifiers: Biochemical treatment, *Physical-chemical treatment, Weak waste water, *Chemical treatment.

A study was conducted to compare the biological, biochemical, and physical-chemical treatment of weak municipal waste water (BOD less than 100 milligrams/liter). It was found that low-level lime addition to high-rate activated sludge treatment moderately improved phosphate removal. Low food: microorganisms ratios and high sludge ages had to be countered to achieve efficient biological or biochemical treatment processes. Colder temperatures had a negative effect on biochemical treatment of normal-strength waste water; an average temperature difference of 12C reduced treatment efficiency as much as one-third. Lime doses high enough to produce a pH greater than 9.5 can be used without harm to bacterial populations when handling weak and normal waste waters due to the fact that carbon dioxide production by microbes can reduce influent pH by 1.5 units. The SVI (sludge volume index) was increased in biochemical treatment by lime addition and colder temperatures. Biological and biochemical treatments were of little use in dissolved solids removal. More than 95% phosphate removal at a high pH can be achieved in the physical-chemical treatment. As 5%, by volume, sludge recycle had

no significant effect on treatment efficiency. Temperature reductions of 12C did not affect physical-chemical treatment at the pH values tested. Physical-chemical processes with lime produced higher removals of BOD, suspended solids, and PO₄ than an activated sludge plant. Low residual phosphate concentrations needed for algae growth were present only with physical-chemical treatment. Advantages and disadvantages of biological and physical-chemical processes can be combined by treating raw waste water by physical-chemical processes when a biological treatment plant is expanded. With enough microbial population in the aeration tank, biochemical treatment of weak waste water is the same as that of normal-strength waste water. (Collins-FIRL)
W77-07916

IN-HOUSE TREATMENT.

The Consulting Engineer, Vol. 41, No. 2, p 25, February, 1977.

Descriptors: *Waste water treatment, *Treatment facilities, Sewage effluents, Industrial wastes, Biochemical oxygen demand, Chemical oxygen demand, Solid wastes, Liquid wastes, Suspended solids, Costs, Waste disposal.
Identifiers: In-house treatment.

Options were presented for in-house treatment to lessen the impact of increased water and effluent charges. This could be accomplished through the reduction of effluent quantities and loads discharged. A formula was presented for the calculation of the cost of volume discharged independently of the load. The formula consisted of fixed elements, variable elements, and quality parameters. In Britain, it costs about 7.5 pounds/cubic meter to treat standard effluents at a sewage works. Just under half of this expense was fixed costs, directly proportional to volume. The remaining costs varied according to the load of BOD, COD, or suspended or settleable solids. The main alternative to disposal to sewers was the removal of some portion of the effluent in a concentrated form for disposal. Constraints and parameters included transportation expenses, treatment costs, discharge standards, possibilities of discharge to rivers, availability of capital and space, and life of process, plant, or factory. (Collins-FIRL)
W77-07917

AWT PLANT MEETS TOUGH DEMANDS,

Benham-Blair and Affiliates, Inc., Oklahoma City, Okla.
J. F. Benham.
Water and Wastes Engineering, Vol. 14, No. 2, p 59-62, 75, February, 1977. 2 tab.

Descriptors: *Tertiary treatment, *Treatment facilities, Phosphate, Biochemical oxygen demand, Biological treatment, Filtration, Trickling filters, Nitrogen, Flows, Equipment, Construction costs, Operating costs, Chemical treatment, Design criteria, Water quality control, Water reuse, *Waste water treatment.
Identifiers: Lawton(OK).

A tertiary treatment facility was constructed in Lawton, Oklahoma, to produce an effluent which meets stringent state requirements. Among these requirements are a 21-day BOD limited to 15.0 milligrams/liter and phosphate concentrations limited to less than 1.0 milligram/liter as phosphorus. Design provisions were made for future expansion to remove nitrogen. A contract with a power generating station calls for the use of purified effluent as make-up for its cooling lake. The treatment incorporates conventional preliminary and primary treatment followed by two-stage biological treatment, chemical precipitation, and granular media filtration. Plastic media trickling filters are used to remove carbonaceous BOD. There is a nitrogenous BOD removal system which is primarily an activated sludge process. The plant

provided an adequate capacity for the treatment of all flow, including wet-weather flow peaks from infiltration and inflow into sewers; flows up to 40 mgd can be accommodated. There is a holding basin with a 15 million gallon capacity for excess flow. Another feature is a 500-acre effluent storage basin for storage of reclaimed water prior to transfer to the power station. Construction costs are \$1.34 per gallon/day capacity and operating costs are expected to be about \$0.25 per thousand gallons. Phosphorus removal consists of three steps: chemical feeding and clarification; recarbonation; and filtration. Planning and design allow an initial capacity of 10 mgd to be expanded by 33% with the construction of an additional trickling filter, aeration tank, and clarifier to most of the unit processes. (Collins-FIRL)
W77-07918

WHAT'S UP WITH OXYGEN,

Brown and Caldwell, Walnut Creek, Calif.
B. D. Bracken.
Water and Wastes Engineering, Vol. 14, No. 3, p 18-22, 24, 26, 44-45, March, 1977. 3 fig, 2 tab, 12 ref.

Descriptors: *Oxygen, *Cryogenics, *Activated sludge, Water quality control, Treatment facilities, Performance, Nitrogen, Equipment, Gases, Design criteria, Economics, *Waste water treatment.
Identifiers: Pressure swing adsorption, Cryogenic air separation.

Applying cryogenic oxygen generation to waste water treatment was considered. With more stringent effluent quality regulations, oxygen activated sludge systems will become more dominant in waste water treatment. The quantities of oxygen needed for treatment will depend upon waste strength, detention time, dissolution system design, waste water temperature, oxygen transfer efficiencies, and other factors. After the decision to use oxygen is made and the quantities necessary are determined, the means for providing pure oxygen must be evaluated. Gaseous oxygen is more economical to purchase than liquid oxygen if it can be piped to the treatment plant from a close generation facility. Liquid oxygen is generally employed for short-term use, oxygen plant start-up, back-up, and emergency use during generation plant failures. On-site generation can be achieved by a pressure swing adsorption (PSA) system for treatment plants using less than 30-40 tons/day of oxygen. Cryogenic air separation plants are usually best for plants exceeding this requirement. The separation plants produce oxygen by liquefaction of pressurized atmospheric air, followed by distillation to separate nitrogen and oxygen. The liquid oxygen is then delivered to a storage and vaporization system for automatic delivery of gaseous oxygen to the oxygen supply lines in response to low pipeline oxygen pressure. The standard plant produces 3-8% of its total output as liquid oxygen. The oxygen generally has a purity of 95-98 mole-percent, or percent by volume. Equipment needed for this process includes an air compressor, switching valves, a cold box, a reversing heat exchanger, a gel trap or hydrogen carbon adsorber, an oxygen superheater, and a nitrogen superheater. (Collins-FIRL)
W77-07919

JOINT MUNICIPAL CORPORATION WASTE WATER TREATMENT,

S. S. Small.
Water and Sewage Works, Vol. 124, No. 1, p 72-75, January, 1977. 1 fig, 2 tab.

Descriptors: *Water districts, *Rural areas, *Community development, Municipal wastes, Industrial wastes, Chemical reactions, Sludge disposal, *Waste water treatment, Treatment facilities, Performance, Costs, Sludge treatment.
Identifiers: Fort Fairfield(ME), The Great Atlantic and Pacific Tea Company, *Joint treatment.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

The rural community of Fort Fairfield, Maine, is constructing a waste water treatment facility to handle municipal and industrial wastes. The Great Atlantic and Pacific Tea Company operates a nearby plant which processes potatoes, french fries, potato puffs, and peas. The Company has installed a starch recovery system, infrared peeling system, caustic and blancher solution recycle systems, and part of a silt removal process in order to reduce waste strength to levels treatable by conventional primary and secondary methods. The plant had previously operated an industrial primary treatment program. The rotating biological surfaces (RBS) secondary treatment process was selected because it meets fluctuations in industrial and domestic loads; is easily expandable for future industrial discharge; does not require sludge recycle; uses smaller secondary clarifiers; and does not flush fixed bio-mass from the reaction tank during peak flows. It also recycles municipal sludge during A and P downtime to maintain a bio-mass sufficient for treating A and P waste water upon start-up, and has trouble-free winter operation and lower overall costs. Finally, it is less complex than other processes. Hypochlorite was chosen for disinfection over chlorine gas because of lower capital costs. Sludge resulting from the process could be used as fertilizer or as an animal food supplement. It was decided to use a flotation thickener for secondary sludge, and a single vacuum filter for dewatering primary sludge to be used for animal feed supplement or for secondary sludge when all sludges would be land-disposed. (Collins-FIRL)
W77-07920

CONTROLLING SLUDGE BULKING.

Water and Sewage Works, Vol 124, No 3, p 54-55, March, 1977. 1 fig.

Descriptors: *Sludge treatment, *Sedimentation, Suspended solids, Bacteria, Sphaerotilus, Sewage bacteria, Hydrogen ion concentrations, *Waste water treatment, Treatment facilities, Oxidation lagoons, Water purification.

Identifiers: Hydrogen peroxide, St Augustine (FL), *Chemical treatment.

A hydrogen peroxide treatment was used to cure sludge bulking at a treatment plant in St. Augustine, Florida. Two years after the transition to secondary treatment, sludge began rising from the bottom of two clarifiers. Sludge was first drawn off into digesters before settling was complete, lowering clarifier solids concentrations. No plant mechanisms had malfunctioned, but the pH rose steadily. The problem was found to be caused by two filamentous bacteria, *Sphaerotilus* and *thiothrix*. Hydrogen peroxide was added at a rate of 20 ppm directly into the head box of the degritter at the 3 mgd facility. A foam problem developed in the clarifiers and the system was relocated to allow peroxide to enter the overflow trough of one of the aeration basins at a rate of 12 ppm. Two days after restarting the facility the clarifiers were clear, foaming was gone, and sludge flocs did not pass over the air. Even later, the filamentous bacteria began to break up. The sludge volume index lowered from a high of 580 to 178, which was well below the bulking point. (Collins-FIRL)
W77-07921

PHYSICO-CHEMICAL TREATMENT OF SEWAGE AND THE COLESHILL PROJECT,

G. F. G. Clough.
Water Pollution Control, Vol 76, No 1, p 10-29, 1977. 6 fig, 1 tab, 2 ref.

Descriptors: *Oxidation, *Separation techniques, Flocculation, Filtration, Separation techniques, Organic matter, Inorganic compounds, Activated carbon, Nitrogen, Phosphorus, Toxicity, Lime, Chlorine, Ozone, Hydrogen ion concentration, Sludge disposal, Sewage treatment, *Waste water treatment, Pilot plants, Treatment facilities, Economics, Industrial wastes, Domestic wastes.

Identifiers: Physico-chemical treatment, Coleshill (England), *Chemical treatment.

Various aspects of the physico-chemical treatment (PCT) of sewage and of the Coleshill pilot plant, in England, were considered. Some of the procedures in this treatment are flocculation using lime or other flocculant materials, foaming, and centrifugation. Solids removal may be required, and filtration may be used when solids concentrations are low. Dissolved organic matter may be treated with chlorine, ozone, lime, or calcium compounds, and removed by using activated carbon. Dissolved inorganic matter, such as nitrogen, phosphorus, and toxic metals, may also be removed by PCT. The use of flocculants will require some sludge dewatering by filter presses, rotary vacuum presses, or filter belt presses and centrifuges. PCT can be cost-competitive if sewage contains toxic materials, phosphorus removal is necessary, space is limited, incineration is the best method for sludge disposal, or if the load changes rapidly or between wide limits. The typical PCT system includes lime addition, settlement, pH correction, and activated carbon treatment. The Coleshill pilot plant consists of fixed and mobile facilities designed to eliminate large-scale trials of various treatment systems. Each mobile unit can perform one unit process operation. The plant can provide a process stream similar to a bench-scale plant, two treatment streams, and two sewage sources, domestic and industrial, for testing. PCT will be the first treatment system tested because of the dearth of information on the performance and economics of the system. (Collins-FIRL)
W77-07922

CONTINUOUS THICKENING OF BIOLOGICAL SLUDGES, AND THE INFLUENCE OF STABILITY,

Water Pollution Research Lab., Stevenage (England).

M. J. D. White, R. C. Baskerville, and C. F. Lockyear.

Water Pollution Control, Vol 76, No 1, p 86-97, 1977. 5 fig, 5 tab, 17 ref.

Descriptors: *Sludge treatment, Physical properties, Chemical properties, *Dewatering, Biochemical oxygen demand, Chemical oxygen demand, Chemical treatment, Anaerobic digestion, Sludge digestion, Activated sludge, Sedimentation, Biological treatment, Costs, *Waste water treatment.

Identifiers: *Gravity thickening.

Gravity thickening was considered in relation to sludge treatment and disposal. The stability of various sludges in storage was studied to determine BOD and COD production, the effect on filterability, and the amount of chemicals needed to condition sludge for mechanical dewatering. Tests were conducted with a small-scale batch thickener and a pilot-scale continuous thickener. A mixed primary sludge was continuously thickened in the pilot-scale thickener with a solids retention time of 18 hours. Solids concentration in the supernatant liquor was about 0.55% dissolved solids. The volume needed for this sludge was less than 75% of the size of the equivalent batch thickener. A continuous thickener size for more dilute feeds would be much smaller than an equivalent batch thickener. Anaerobically digested sludge and sludges from low-rate and extended-aeration activated sludge plants were relatively stable in terms of BOD and COD release into the liquor, and in terms of filtration characteristics. No penalties resulted from thickening this sludge. Primary and mixed primary sludge samples from sedimentation tanks were relatively stable. Filtration properties and the BOD and COD of the interstitial liquor revealed that significant deterioration had occurred in the sedimentation tank. High-rate biological treatment sludges were very unstable. Dewatering costs for these sludges were very high and substantial BOD and COD loadings might

result from the return of their supernatant from thickeners to the head of the treatment facility. Gravity thickening was judged unsuitable for these sludges. (Collins-FIRL)
W77-07923

THE EFFECT OF TIME DELAY AND GROWTH RATE INHIBITION IN THE BACTERIAL TREATMENT OF WASTE WATER,

Teesside Polytechnic, Middlesbrough (England).
Dept. of Mathematics and Statistics.

A. W. Bush, and A. E. Cook.

Journal of Theoretical Biology, Vol. 63, No. 2, p 385-395, 1976. 8 ref.

Descriptors: Model studies, *Inhibition, Mathematical models, Analysis, *Growth rates, *Bacteria, *Nutrients, *Biological treatment, *Waste water treatment, Microorganisms.

Identifiers: Monod models, Substrate concentrations.

Investigations were conducted of the Monod and similar models incorporating inhibitory effects of huge nutrient concentrations on bacterial growth rates. The behavior of continuous culture systems, with and without time delay, were studied. Biological waste water treatment is an example of a system subject to failure from shock loading resulting from the inhibitory effect. Equations were presented to determine the relationship of microorganism concentrations to substrate concentrations and to determine the inhibitory effects of high substrate concentrations. Parameters of system operation failures such as shock overloading and underloading were also developed. (Collins-FIRL)
W77-07924

EFFECTS OF POLYELECTROLYTES AND CLAY COLLOIDS ON CARBON ADSORPTION,

Missouri Univ.-Columbia.

J.-C. Huang, and J. T. Garrett.

Water and Sewage Works, Vol. 124, No. 3, p 64-67, March, 1977. 8 fig, 1 tab, 5 ref.

Descriptors: *Analytical techniques, *Activated carbon, *Polyelectrolytes, *Clays, Illite, Kaolinite, Montmorillonite, Inhibition, Particle size, Phenols, Performance, Physical properties, Chemical properties, *Waste water treatment.

A study was conducted to investigate the effects of polyelectrolyte molecules and/or colloidal particles in waste water on the porous structure of activated carbon. How various types of activated carbon would be affected if blockage occurs which reduces activated carbon effectiveness was also investigated. Cationic, anionic and nonionic polyelectrolyte were used and illite, montmorillonite, and kaolinite clays were employed. Phenol was used as the adsorbate. Activated carbons tested were coal-based, petroleum-based, wood-based, and lignite-based. Results indicated that almost no inhibition of carbon adsorption was caused by the colloidal materials or the polyelectrolytes used. The lack of inhibition by the polyelectrolytes studied was attributed to the lack of activated carbon affinity for them. Failure of the clays to create any inhibition was considered to be due to a lack of affinity between carbon and clay particles and to the fact that clay particles were too large to effectively block any capillary pores. (Collins-FIRL)
W77-07926

THE ACTIVATED SLUDGE PROCESS WITHOUT PRELIMINARY PURIFICATION. RESULTS OF PILOT EXPERIMENTS IN THE PURIFICATION PLANT KARLSRUHE (DAS BELEBUNGSVERFAHREN OHNE VORREINIGUNG. ERGEBNISSE DER VERSUCHE IM HALBTECHNISCHEN MASSSTAB IM KLAERWERK KARLSRUHE),
L. Mueller.

Gas-und Wasserfach-Wasser/Abwasser, Vol. 118, No. 1, p 15-23, 1977. 10 fig, 1 tab, 9 ref.

Descriptors: *Analytical techniques, *Activated sludge, *Waste water treatment, Model studies, Municipal wastes, Aeration, Bacteria.
Identifiers: Sludge volume index, Settling properties.

The activated sludge process was studied in pilot experiments with waste water consisting of 45% municipal and 55% industrial waste water at the Karlsruhe waste water treatment plant. The waste water was admitted to the single-stage aeration tank without preliminary purification after the sand trap. Compared with activated sludge from the conventional process with preliminary purification, the sludge from the one-stage process had markedly improved settling properties. The sludge volume index was 51-80 mg/liter, compared with 100 mg/liter in the case of preliminary purification. The adaptation time was about half of that required in the two-stage process, which may be due to the rapid activation of bacterial colonies which would be removed during the preliminary purification. The solids content of the return sludge was surprisingly high compared with that in the two-stage process. Good purification efficiency was achieved even with high sludge loads (93.1-96.5% with an initial load of 0.19-1.27 kg BOD₅/kg dry matter/day). (Takacs-FIRL)
W77-07927

ISRAEL'S USE OF NONIONIC SURFACTANTS, Technion - Israel Inst. of Tech., Haifa. Environmental Engineering Labs.
For primary bibliographic entry see Field 5B.
W77-07929

COST OF HIGH QUALITY WASTE WATER TREATMENT FOR REUSE, Envirotech Corp., Salt Lake City, Utah. Eimco BSP Div.
A. S. Anand, O. E. Albertson, and R. D. Fox. Effluent and Water Treatment Journal, Vol. 17, No. 2, 67-73, February, 1977. 9 fig, 4 tab, 14 ref.

Descriptors: *Costs, *Water reuse, *Waste water treatment, Design criteria, Water quality, *Treatment facilities, Filtration, Activated carbon, Tertiary treatment, Industrial wastes, Water quality control.

A study was conducted to determine the cost of waste water treatment as a function of plant size, waste characteristics, and degree of treatment. The analysis was based on flow sheet combinations of the following factors: three plant sizes, two waste water strengths, and three levels of effluent quality. Cost analysis included construction costs, operational costs, equipment costs, and chemical costs. The relative costs of primary, secondary, and tertiary treatment processes were given, as were costs for dewatering and disposal methods. (Collins-FIRL)
W77-07930

DRAINAGE—WHO PAYS, RESPONSIBILITIES AFTER THE 1973 WATER ACT, Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
For primary bibliographic entry see Field 5G.
W77-07932

INDUSTRY MONITORS COUNTY STORM SEWER WATER, Case (J. L.), Co., Racine, Wis.
F. Tilsner. Water and Sewage Works, Vol. 124, No. 3, p 56-57, March, 1977. 1 fig.

Descriptors: *Storm drains, *Monitoring, Pumping plant, Filters, *Industrial wastes, Domestic wastes, Liquid wastes, Oil wastes, Chemical

wastes, Flow, Separation techniques, Water purification, Pollution abatement, *Waste water treatment.

A storm sewer and its monitoring by a Wisconsin tractor plant and foundry operation were described. The system is completely open and susceptible to contamination by oil and other waste matter. An oil interceptor system was installed at the sewer outlet to a lake. It was divided into two units, a pump basin and a filter building. The pump basin is the primary monitoring and flow controlling station of water into the lake. Water passes over a baffle for the removal of heavy solids or debris, then through the pump house via a screened inlet so that floatable materials which passed the baffle are removed. Another baffle traps floatable oil or process liquid in the basin, while an oil skimming unit continuously removes surface oils. Water contaminated by matter which mixes with it is transferred to the filter house which has primary and secondary solids separators. It is then moved to a pre-filter tank or to the secondary separator if further solids removal is necessary. Solids and debris collected are transferred to an outside collection tank for pumping to the waste treatment plant grit chamber for ultimate disposal. An operator monitors the system's performance for possible pollution problems and controls the equipment. (Collins-FIRL)
W77-07933

LESS-COSTLY ACTIVATED CARBON FOR SEWAGE TREATMENT, NASA Tech. Briefs, Vol. 1, No. 4, p 573, Winter, 1976. 1 fig.

Descriptors: *Carbon, *Activated carbon, *Coal, *Lignite, Heat treatment, *Sewage treatment, Sludge, Adsorption, Chemical oxygen demand, *Waste water treatment.
Identifiers: Sodium carbonate, Pyrolysis.

A process was developed to produce supplemental carbon from coal for activated carbon sewage treatment. The goal was to make the activated carbon process self-sustaining. Coal is pyrolyzed with sludge which becomes a catalyst in the activation process. Gases which may be used to reduce the energy demand are produced during pyrolysis. Laboratory pyrolysis of a 50/50 mixture of pulverized coal and sludge was conducted at 850°C with a 20-minute steam application (1 pound of steam per pound of coal/sludge mixture). The resultant activated carbon was 61.7% ash with an iodine adsorption of 684 milligrams/gram of carbon. A sludge with a COD of 421 was reduced to a COD of 54 by treatment with 521 milligrams/liter of the activated carbon. Treatment with a commercial activated carbon produced a COD of 60. Lignite was the most effective coal for this purpose; sodium carbonate may be added to enhance activation. (Collins-FIRL)
W77-07934

STATE PARK GETS GOOD TREATMENT, EFFLUENTS WILL BE USED FOR IRRIGATION TO REDUCE EXTENSIVE REQUIREMENTS, Lockwood, Andrews and Newnam, Austin, Tex.
F. A. Jay, and J. L. Kroesche. Water and Wastes Engineering, Vol. 13, No. 11, p 65-66, 71, November, 1976. 1 fig.

Descriptors: *Parks, *Recreational facilities, *Aeration, *Sewerage, Piping, *Waste water treatment, Flows, Treatment facilities, Pumping plants, Irrigation, Biochemical oxygen demand, Suspended solids, Lakes, Nutrients, Sludge treatment, Design criteria, *Texas.
Identifiers: *Inks Lake State Park(TX).

A treatment system was designed for the Inks Lake State Park in Texas. Design considerations included: the handling of seasonal flow variations, a hilly and rocky terrain, a low budget, more than 250 camp and picnic units, and rest rooms. A solu-

tion comprising a pressurized collection network, a variable capacity extended-aeration treatment plant, and an effluent irrigation system was devised. Seasonal waste water flows averaged 6,000 mgd in winter, 20,000 gpd during the spring and fall, and 40,000 gpd in summer. By using the pressurized collection system costs and excavation difficulties presented by an abundance of granite in the area were avoided. Twelve grinder pumping stations with pumps mounted in 60-inch wet-wells of a 5.5-foot depth were constructed. Existing rest rooms septic tanks or 1000 gallon concrete tanks provided emergency holding capacity. The forced main network is made of two-to four-inch polyvinyl chloride pipe. An effluent quality of 20 milligrams/liter BOD and 20 milligrams/liter total suspended solids was required for irrigation. State restrictions on discharges to lakes are 5.0 milligrams/liter BOD and 5.0 milligrams/liter total suspended solids, and they often include nutrient removal. Extended aeration provides protection against biological upset and reduces sludge handling requirements. All systems can be expanded if necessary. (Collins-FIRL)
W77-07936

R AND D PROJECT PROVIDES PHYS/CHEM DATA, FOXBOROUGH (MASS) STATE HOSPITAL PLANT CAN PRODUCE 'SUPERIOR EFFLUENT QUALITY', Cleverdon, Varney and Pike, Boston, Mass.
J. T. Gervais. Water and Wastes Engineering, Vol. 14, No. 2, p 55-57, February, 1977. 1 fig, 1 tab.

Descriptors: *Treatment facilities, *Research and development, *On-site investigations, Design, Costs, Prototypes, Research facilities, Tertiary treatment, *Waste water treatment, Chemical treatment, Adsorption, Filtration, *Massachusetts, *Hospitals.
Identifiers: Foxborough State Hospital(MA).

A research and development project was instituted at Foxborough State Hospital, Massachusetts, to demonstrate physical-chemical waste water treatment processes and to train operators. Chemical clarification, dual media filtration, and carbon adsorption processes were investigated. The facility was designed to accommodate future investigations of treatment methods. It is housed by a fabric-skinned structure which is functional, portable, economical, and salvageable. All process equipment is standard and can be reused at other facilities. The facility was operated in a manner which simulated that of an actual treatment plant. Dual systems are provided for direct comparison testing. Polyvinyl chloride is used for all process lines. The facility has proven the feasibility of adding these treatment processes to secondary facilities to meet water standards. (Collins-FIRL)
W77-07937

1976-1976: NOTES ON WATER QUALITY PLANNING, Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W77-07938

WATER AND WASTE WATER ENGINEERING FOR LOW INCOME COMMUNITIES IN DEVELOPING COUNTRIES, For primary bibliographic entry see Field 5G.
W77-07939

STABILIZATION LAGOONS-INCLUDING EXPERIENCE IN BRAZIL, Balfour (D.) and Sons, Sao Paulo (Brazil). R. M. Bradley, and M. O. S. Alvares da Silva. Effluent and Water Treatment Journal, Vol. 17, No. 1, p 21-23, 26-29, January, 1977. 3 fig, 4 tab.

Descriptors: *Oxidation lagoons, *Design criteria, *Domestic wastes, *Aerated lagoons, Economics,

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Effluents, Biochemical oxygen demand, Suspended solids, Algae, Climates, *Waste water treatment, Sanitary engineering.
Identifiers: *Brazil, Facultative lagoons.

Design criteria and operation data for lagoon systems treating domestic sewage in Brazil were discussed. There is no internationally accepted design procedure for stabilization lagoons since their operation efficiency depends on the climatic conditions of a given area. With adequate available land, these lagoons are an inexpensive means for reducing domestic sewage BOD. Greater efficiency, as well as land and excavation savings, result from using an anaerobic and facultative lagoon in series. In Brazil, using this method rather than a single facultative lagoon produces a 70% reduction in land area requirements, a 45% reduction in excavation volume, and a 55% detention time reduction, while yielding an effluent of the same quality. Facultative lagoons always contain algae. When 85-90% BOD removals are necessary, algal removal should be practiced. Facultative lagoons produce an effluent with substantial suspended solids, mainly algae, which are harmful to receiving streams. Aerated aerobic lagoons have a higher operational cost and produce an effluent higher in suspended solids concentrations than facultative lagoons. Brazilian practice is to accept the algae problems in order to achieve, over the widest area possible, some measure of reduction in the organic loads discharged to rivers. Basic sanitation can thus be provided to as many communities as possible, and effluent quality can be improved as financial resources increase. In densely populated areas, because land is scarce and effluent quality standards are to be raised, it is usual to use aerated lagoons which are convertible to activated sludge systems. (Collins-FIRL)

W77-07940

WASTE WATER RENOVATION BY SEWAGE ULTRAFILTRATION.

Israel Desalination Engineering Ltd., Tel Aviv.
S. B. Sachs, and E. Zisner.
Desalination, Vol 20, p 203-215, 1977. 5 fig, 8 tab, 4 ref.

Descriptors: *Membranes, *Filtration, *Reverse osmosis, *Pilot plants, Polyelectrolytes, Polymers, Oxidation lagoons, Sewage effluents, Water purification, Water reuse, Organic matter, Biochemical oxygen demand, Chemical oxygen demand, Physical properties, Chemical properties, *Waste water treatment, *Sewage treatment.
Identifiers: Hybrid ultrafiltration(HUF) membranes, *Ultrafiltration(SUF).

Pilot studies were conducted to determine the feasibility of using the newly developed Hybrid Ultra Filtration (HUF) membranes to treat municipal oxidation pond effluent. The process, Sewage Ultrafiltration (SUF), combines ultrafiltration and reverse osmosis methods and treats the entire system by separating water from many types of contaminants. These membranes are non-cellulosic and resistant to hydrolysis or biological degradation; some of them withstand temperatures up to 120°C. The membranes are made of a strong polyelectrolyte permanently attached to an inert polymer porous structure. They carry a fixed charge capacity over the whole pH range. Tests showed impressive performance at low operating pressure (8 atm). There was a constant product flux through the membrane of 30-40 gfd at 95% water recovery. The system was cleaned by a sponge-ball once every 24-hours. The HUF membrane substantially reduced organic contaminants from very high concentrations to a lower level than biological or physicochemical processes would under similar conditions. The test plant removed 98% of total BOD and 78% of total COD in the oxidation pond feed, which was 99.3% of BOD and 99.4% of COD from the recirculation brine. Only minor treatment is needed to use this effluent for agriculture, groundwater recharge, industrial purposes, or complete municipal recycle. (Collins-FIRL)

W77-07941

BIOLOGICAL REGENERATION OF AMMONIUM-SATURATED CLINOPTILOLITE. I. INITIAL OBSERVATIONS.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
M. J. Semmens, and R. R. Goodrich, Jr.
Environmental Science and Technology, Vol 11, No 3, p 255-259, March, 1977. 5 fig, 2 tab, 12 ref.

Descriptors: Analytical techniques, *Zeolites, *Ion exchange, *Ammonium compounds, *Biological treatment, Sewage effluents, Sludge treatment, Nitrification, Salts, Chemical treatment, Brines, *Waste water treatment, *Bacteria, Nitrogen fixing bacteria, Biological treatment.
Identifiers: *Clinoptilolite regeneration, *Nitrifying bacteria.

A study was initiated to determine whether nitrifying bacteria could regenerate clinoptilolite and, if so, the degree of regeneration in different time periods with different bacterial concentrations. Known weights of ammonium saturated clinoptilolite were contacted with various concentrations of nitrifying sludge of known activity. Results indicated that regeneration was possible and that the process was very rapid. The regeneration time depended upon the nitrifying capacities of the sludges. High sludge concentrations produced as much as 80% regeneration in less than two hours of contact time. Nitrification rates during regeneration were much slower than those of free ammonium in solution. It was not clear whether the amount of available ammonium limited the rate of nitrification. However, ammonium concentrations in solution were in the range in which the nitrification rate was a function of ammonium concentration. Increasing the salt concentration in solution may improve regeneration rates if the free ammonium concentration in the solution is the controlling factor in the rate of nitrification. Clinoptilolite must be used as an ion exchanger first, and biologically regenerated, in the manner of chemical regeneration, if its exchange capacity and ammonium ion selectivity are to be fully utilized. This would produce a nitrate brine which can be denitrified in many ways, thereby representing an advantage in favor of biological regeneration. (See also W77-07943) (Collins-FIRL)

W77-07942

BIOLOGICAL REGENERATION OF AMMONIUM-SATURATED CLINOPTILOLITE. II. MECHANISM OF REGENERATION AND INFLUENCE OF SALT CONCENTRATION.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
M. J. Semmens, J. T. Wang, and A. C. Booth.
Environmental Science and Technology, Vol 11, No 3, p 260-265, March, 1977. 8 fig, 1 tab, 20 ref.

Descriptors: Analytical techniques, *Zeolites, *Nitrification, *Ion exchange, *Ammonium compounds, *Salts, *Inhibition, Performance, Sodium chloride, *Biological treatment, *Bacteria, Economics, Brines, *Waste water treatment, Brine disposal.
Identifiers: Clinoptilolite regeneration, *Nitrifying bacteria.

The influence of salt concentrations on clinoptilolite regeneration, and the mechanism thereof, were investigated. Previous studies suggested, and this one confirms, that the solution concentration of ammonium controls nitrification rates and that this is controlled by the amount of ammonium displaced by ion exchange. Increasing ion exchange rates by decreasing clinoptilolite particle size and increasing solution salt concentrations increased the rate of regeneration. Nitrifying bacteria were significantly inhibited by salt concentrations higher than 0.6 M and, at one M salt concentration, no nitrification was observed. Salt also stimulated nitrifying bacteria in low concentrations of 0-0.4

M. It was found that salt could produce higher regeneration levels. About 99% regeneration was achieved in less than 3 hours when 400 meq/liter of sodium chloride were added to the regeneration factor. It was concluded that nitrification in concentrated salt solutions was a prerequisite to economical operation in a biological regeneration process. This produces little excess brine for disposal. Satisfactory regeneration may be attained by using a salt brine for ammonium extraction and biologically restoring the brine for reuse. (See also W77-07942) (Collins-FIRL)

W77-07943

BACTERIAL POPULATIONS AND END PRODUCTS DURING ANAEROBIC SLUDGE FERMENTATION OF GLUCOSE.

North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
D. P. Chynoweth, and R. A. Mah.
Journal Water Pollution Control Federation, Vol 49, No 3, p 405-412, March, 1977. 4 fig, 4 tab, 12 ref.

Descriptors: *Bacteria, *Fermentation, *Anaerobic conditions, *Carbohydrates, Nutrients, *Sludge digestion, *Waste water treatment, Gases, Metabolism, Microorganisms, *Sludge treatment.
Identifiers: Glucose.

A study was performed to investigate changes in bacterial populations during anaerobic sludge fermentation of glucose to evaluate that substrate. No response was evident for 8 to 10 hours after the addition of glucose to unenriched digesting sludge. At that point, there was a sudden and rapid increase in gas production and accumulation of acetate, propionate, and ethanol. This resulted from a sudden selective growth of euryoxic bacteria. Isolates from the enriched sludge were characterized as the *Escherichia* genus and Providence group, and produced fermentation products identical to those in enriched sludge in high concentrations. These activities and growths indicate the imbalance which occurs when substrates added to anaerobic digesters are changed. Continued bacterial population imbalance in fermentation could lead to the accumulation of toxic products and the end of decomposition. Data indicated that digester sludge acclimatization to pure substrates causes a great change in the natural bacterial populations. (Collins-FIRL)

W77-07944

SEWAGE SLUDGE DISPOSAL: A STICKY PROBLEM WITH NO FAIL-SAFE ANSWER.

For primary bibliographic entry see Field 5E.
W77-07948

THE USE OF SEWAGE EFFLUENT AS POWER STATION COOLING WATER.

Central Electricity Generating Board, Leatherhead (England). Croydon Power Station.
For primary bibliographic entry see Field 5G.
W77-07949

SOME REFLECTIONS OF A SEWAGE WORKS MANAGER.

Severn-Trent Water Authority, Birmingham (England).
W. Batters.
The Public Health Engineer, Vol. 5, No. 2, p 51, March, 1977.

Descriptors: *Treatment facilities, *Operations, *Maintenance, *Monitoring, Equipment, Design criteria, Activated sludge, Flow, Aeration, Anaerobic bacteria, Sludge digestion, Chemical treatment, Biological treatment, Performance, Costs, *Waste water treatment.
Identifiers: Coleshill Works(Birmingham England).

Observations on sewage treatment at the Colehill Works, Birmingham, England, were made by its manager. Communication between designers and operators of sewage treatment facilities was a prime concern. The difficulties in reacting to flow variations and in synchronizing treatment processes were considered. It was suggested that sampling should be followed through on a time basis, and not as a sequence of numbers or sampling points. The air supply to aeration tanks should be regulated based on the influent flow to and the sedimented effluent strength of the aeration tanks. It was also suggested that tank performance should not be gauged totally by the meters, and that experience was the best basis for creating a proper atmosphere for biological activity. Heated sludge digestion should be considered because it utilizes anaerobic bacteria and provides a reliable gas source for power generation, if kept under control. Chemical treatment was considered, but it has the drawback of making treatment costs dependent upon material costs rather than on plant and operator efficiency. Fear was expressed that inflation and the scarcity of chemical supplies would create a crisis similar to that in the oil industry. (Collins-FIRL)
W77-07952

PROCESS TECHNOLOGICAL BACKGROUND REGARDING NEW PROTECTIVE REGULATIONS FOR WATER BODIES—RESULTS OF EXPERIMENTS ON NITRIFICATION AND PHOSPHORUS ELIMINATION IN ZÜRICH AND BERN. II. PROCESS TECHNOLOGICAL BACKGROUND OF NITRIFICATION IN ACTIVATED SLUDGE PLANTS (VERFAHRENTHEORETISCHE UNTERLAGEN IM HINBLICK AUF DIE NEUEN GEWÄSSERSCHUTZ-ANFORDERUNGEN—ERGEBNISSE DER VERSUCHE UEBER DIE NITRIFIKATION UND PHOSPHORELIMINATION IN ZÜRICH UND BERN. II. VERFAHRENTHEORETISCHE GRUNDLAGEN DER NITRIFIKATION IN BELEBTSCHLAMMANLAGEN).
W. Gujer.
Gas-Wasser-Abwasser, Vol. 56, No. 11, p 609-614, 1976. 10 fig, 3 tab, 6 ref.

Descriptors: *Treatment facilities, *Model studies, *Activated sludge, *Nitrification, Evaluation, Pilot plants, Laboratory tests, On-site tests, Temperature, Theoretical analysis, *Waste water treatment.

Results of pilot and laboratory experiments with activated sludge were evaluated with theoretical explanations. The effects of temperature and digester supernatant on nitrification were explored. A dynamic simulation model was used to describe performance in nitrifying activated sludge plants, with good accuracy, by the hour and for longer time periods. (Collins-FIRL)
W77-07953

TRIALS ON THE OPERATION OF BIOLOGICAL FILTERS.
K. G. Pullen.
Water Pollution Control, Vol. 76, No. 1, p 75-85, 1977. 5 fig, 2 tab, 3 ref.

Descriptors: *Filters, Analytical techniques, *Filtration, *Biological treatment, Treatment facilities, Plastics, Capital costs, Waste water treatment, Pilot plants, Performance, Filters.
Identifiers: Alternating double filtration (ADF), Balanced flow, Balanced loading, *Biological filters.

The operation of biological filters was studied to aid upgrading of treatment facilities. Three full-scale trials and one pilot-scale trial were conducted. At small and medium-sized works that pump crude sewage on-site, alternating double filtration (ADF) should be used when the design capacity on single filtration of the facility has been

reached. Increased loadings can be handled with no increase in capital expenditures. Plastic media can be utilized in situations where very large loadings will be treated with single filtration systems. Partial replacement of conventional media would be advantageous. When loadings are only two to three times greater than normal, the plastic media may not perform any better than conventional filters. Further investigation was suggested for balanced flow and loading methods. It is possible that capital costs can be reduced by constructing smaller filter and primary sedimentation tank capacities if increased revenue costs are acceptable for small to medium treatment plants. Too much capital should not be invested in monolithic structures if the 'throw-away' sewage treatment works stage is reached in less than 25 years. (Collins-FIRL)
W77-07954

THREE CASE STUDIES ON THE APPLICATION OF THE STORM WATER MANAGEMENT MODEL.
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 5B.
W77-07955

METHOD OF FILTERING OIL FROM LIQUIDS.
Hydromation Filter Co., Livonia, Mich. (Assignee).
For primary bibliographic entry see Field 5G.
W77-08011

METHOD OF FILTERING LIQUIDS CONTAINING DISSOLVED CARBON DIOXIDE.
Schlitz (Joseph) Brewing Co., Milwaukee, Wis. (Assignee).
J. E. Sawicki, and J. P. Murdock.
U.S. Patent No. 3,992,293, 4 p, 2 fig, 8 ref; Official Gazette of the United States Patent Office, Vol. 952, no 3, p 1209-1210, November 16, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution control, Water quality control, *Filtration, *Carbon dioxide, Frothing, Alkalinity, Hydrogen ion concentration.
Identifiers: Brewing process.

In the normal brewing process there are a number of different liquid residues of effluents resulting from the various operations in the overall process. When using vacuum filtration equipment to filter the liquid residue or effluent, tremendous quantities of foam are generated due to the dissolved carbon dioxide. This invention is directed to a method of reducing foam generation during processing of a carbonated liquid from brewing processing during vacuum filtration. A water soluble alkaline material, such as an alkali metal hydroxide, is added to the liquid in sufficient quantity to raise the pH to a value in the range of 6.5 to 8.0. The alkaline material will react with the dissolved carbon dioxide to form carbonates. The elimination of the dissolved carbon dioxide substantially decreases foam generation during the vacuum filtration and increases the rate of filtration. (Sinha-OEIS)
W77-08013

METHOD OF SEPARATION OF FISSION AND CORROSION PRODUCTS AND OF CORRESPONDING ISOTOPES FROM LIQUID WASTE.
Ceskoslovenska Komise pro Atomovou Energii, Prague. (Assignee).
H. Prochazka, K. Stamberg, R. Jilek, P. Hulak, and J. Katzer.
U.S. Patent No. 3,993,558, 5 p, 10 ref; Official Gazette of the United States Patent Office, Vol. 952, no 4, p 1729, November 23, 1976.

Descriptors: *Patents, *Waste water treatment, Radioactive waste, Water pollution sources, Radioisotopes, Fungi, Sorption, Separation techniques, Liquid wastes, *Corrosion.

Identifiers: *Fission products.

Alkali-metals, earth alkali metals, transition elements, halogenides, rare earth elements and other groups of elements are present in the fission products. Their separation from aqueous waste requires the application of different processes and methods corresponding to the different chemical and physical properties of the fission products. Actual cleaning processes used for neutralizing radioactive waste are based on principles such as evaporation, precipitation, co-precipitation, and sorption. Mycelia of fungi are used as sorbents for retaining the products on their surface and within their pores. The invention includes methods of activation or regeneration of the sorbent. (Sinha-OEIS)
W77-08020

PROCESS FOR ELIMINATING REACTIVE CHLORINATED ORGANIC COMPOUNDS FROM AQUEOUS SOLUTIONS.
Wacker-Chemie G.m.b.H., Munich (West Germany). (Assignee).
W. Opavsky, and E. Macpherson.
U.S. Patent No. 3,993,559, 4 p, 5 ref; Official Gazette of the United States Patent Office, Vol. 952, no 4, p 1729, November 23, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Organic compounds, Chemical wastes, Water pollution sources, Chlorine, Chemical reactions, Aqueous solutions.
Identifiers: *Chlorinated organic compounds.

The invention provides a method by which waste waters containing aqueous solutions, particularly chlorinated organic compounds could be treated in a simple manner in order to decrease the content of chlorine to a large degree and render an essential part of the organic compounds removable. The waters are treated at 70-300°C, preferably 100-160°C, with ammonia or compounds splitting off ammonia, and/or by primary amines or compounds splitting off primary amines, and separating the difficulty soluble reaction products. (Sinha-OEIS)
W77-08021

SEWAGE SLUDGE TREATMENT SYSTEM.
California Inst. of Tech., Pasadena. (Assignee).
J. J. Kalvinskas, and W. A. Mueller.
U.S. Patent No. 3,994,804, 5 p, 1 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 952, No 5, p 2160-2161, November 30, 1976.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, Water pollution treatment, *Water pollution control, Water quality control, Activated carbon, Sludge, Settling basins, Sewage sludge.
Identifiers: Pyrolysis.

An improved method and means in the processing of raw liquid sewage which contains suspended matter is disclosed. It has been found that the ash content of the material coming out of the pyrolyzer is quite high, as much as 75%. This consists primarily of sand and clay that comes in with the raw sewage. This excessive ash constitutes a bulk which interferes with the effective adsorption of the dissolved solids and damages the ability of the carbon to meet the BOD standards. Thus the necessary removal of ash to reduce its amount also results in the removal of a proportionate amount of carbon. By separately pyrolyzing the respective sludges from the first and second settling tanks, and returning the separately obtained pyrolyzed material to the tanks from which they came, it has been found that the adverse effects of the excessive ash buildup is minimized, the carbon yield is increased, and the sludge from the secondary tank can be pyrolyzed into activated carbon to be used as indicated many more times than was done before exhaustion occurs. (Sinha-OEIS)
W77-08030

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

COMPOSITION AND METHOD FOR FLOCCULATING SUSPENDED SOLIDS,
Calgon Corp., Pittsburgh, Pa. (Assignee).
E. G. Rausch, and R. A. Muia.

U.S. Patent No. 3,994,806, 5 p., 4 tab., 6 ref.; Official Gazette of the United States Patent Office, Vol. 952, No. 5, p. 2161, November 30, 1976.

Descriptors: *Patents, *Water treatment, Water quality control, *Water purification, *Flocculation, Suspended solids, Organic compounds, *Polymers, *Waste water treatment.
Identifiers: *Cationic polymers, *Nonionic polymers.

In the flocculation and removal of suspended matter from water, combinations of cationic and nonionic water-soluble polymers are found to be more effective than equivalent concentrations of cationics alone, and significantly lower concentrations of the combination are found to be equivalent in effect to higher concentrations of cationic polymers alone. The cationic polymers useful in the invention are high molecular weight, water-soluble, cationic polymers. These polymers are prepared by utilizing any of the well known cationic monomers that readily undergo free radical polymerization. In addition, some of the useful cationic polymers are prepared by condensation polymerization. (Sinha-OEIS)
W77-08031

USE OF STATE ESTIMATION TECHNIQUES IN WATER RESOURCE SYSTEM MODELING, BY DENNIS P. LETTENMAIER AND STEPHEN J. BURGESS,

International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W77-08035

SIMPLIFIED OPTIMIZATION OF ACTIVATED SLUDGE PROCESS,
Purdue Univ., Lafayette, Indiana. School of Civil Engineering.

C. P. L. Grady, Jr.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE3, Proceedings paper No. 12974, p. 413-429, June 1977. 3 fig., 6 tab., 19 ref.

Descriptors: *Waste water treatment, *Activated sludge, Water quality control, *Dynamic programming, *Optimization, *Economic efficiency, Design, Suspended solids, Annual, Costs, Decision making, Mathematical models, Equations, Operations research, Waste water(Pollution).
Identifiers: *Economic analysis, *Cost minimization.

The objective function minimized is the total annual cost associated with the primary settler, aeration basin, blowers, final settler, and recycle pumps. The key to the application of dynamic programming is the proper selection of state and decision variables. The input state to the primary settler is the waste strength, and the decision variable is the removal efficiency, giving the strength of the primary effluent as the input state to the aeration basin. Both the decision variable and the output state for the aeration basin are the mixed liquor suspended solids (MLSS) concentration thus fixing the required volume. Utilizing the MLSS concentration as the input state to the final settler allows the use of the recycle ratio as the decision variable, thereby fixing the required surface area. A tabular format is presented whereby the optimization may be performed simply and efficiently without the use of a computer. It is concluded that dynamic programming is a simple and reliable processing train of a completely mixed activated sludge system after selection of solids retention time. (Bell-Cornell)
W77-08036

BEST PRACTICABLE WASTE TREATMENT SCREENING MODEL,

Cornell Univ., Ithaca, N. Y. Dept. of Civil and Environmental Engineering.
D. A. Haith, and D. C. Chapman.

Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE3, Proceedings paper No. 12980, p. 397-412, June 1977. 1 fig., 8 tab., 25 ref.

Descriptors: Water quality, *Sewage treatment, *Land use, *Costs, *Simulation analysis, *Dynamic programming, Optimization, Dissolved oxygen, Surface waters, Groundwater, Estimating, Alternative planning, Management, Equations, Waste disposal, Waste water(Pollution), Mathematical models, Operations research, *Waste water treatment.
Identifiers: *Screening model, Cost minimization, Sensitivity.

A mathematical model has been developed for the preliminary screening of wastewater management alternatives involving treatment and discharge to receiving waters and land application. The model, which utilizes simulation and/or dynamic programming, consists of dissolved oxygen modeling of receiving waters, mass balances of nitrogen and water at the land application site, and cost estimating equations. The model is used to assess costs and water quality impacts on surface and groundwaters of wastewater management options. The model objective is the identification of alternatives that demonstrate "cost-effective potential" as specified in regulations for "best practicable waste treatment technology" (BPWTT). The screening model has been utilized to evaluate wastewater management alternatives for a hypothetical city with a wastewater flow of 10 mgd. The model is shown to be effective for screening treatment alternatives; it permits a simple inexpensive systematic evaluation of the costs and environmental impacts of large numbers of management alternatives. (Bell-Cornell)
W77-08037

WASTE WATER TREATMENT BY UPFLOW SAND FILTRATION,

Tulane Univ., New Orleans, La.
F. Itihadih.
PhD Thesis, 1976. 215 p.

Descriptors: *Filters, *Soil filters, Filtration, Design, Potable water, Water reuse, Flow rates, Waste water treatment, Oxygen demand, Water purification, Coagulation, Flocculation, Suspended solids, Domestic wastes.
Identifiers: Upflow filtration.

Upflow sand filtration systems were investigated to determine solutions to some design problems. Parameters tested were sand media sizes, flow-rates of waste water through filters, coagulation-flocculation, pressure buildups and head losses, and removal rates of suspended and dissolved material and oxygen demands. The degree of treatment under various filtration conditions was determined and the results were evaluated. A study was conducted to test activated sludge plant effluent, trickling filter plant effluent, and primary effluent. Results indicated that the upflow method was useful as a clarification unit and for filtering activated sludge effluent. The methods for laboratory evaluation of coagulation, flocculation, and filtration were useful and necessary. When activated sludge effluent was treated in the normal manner, there was effective removal of suspended and colloidal materials. Removal was good with 44-inch No. 8-20 or No. 6-12 size media at flow rates of 6 and 8 gpm/square foot. The coagulation-filtration tests revealed that better clarification was obtained with strong waste waters than with weak waste waters. (Collins-FIRL)
W77-08087

SKIMMER APPARATUS FOR SEWAGE SETTLING TANKS AND THE LIKE,
Sybron Corp., Rochester, N.Y. (Assignee).
For primary bibliographic entry see Field 5G.
W77-08088

METHOD FOR IMPROVING THE QUALITY OF CONTAMINATED WASTE WATER,

Chemfix, Inc., Pittsburgh, Pa. (Assignee).
J. R. Connor, E. A. Zawadzki, and R. J. Polosky.
United States Patent 4,012,320. Issued March 15, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 3, p. 958, March, 1977. 1 fig.

Descriptors: *Patents, *Adsorption, *Separation techniques, Water quality, *Waste water treatment, Pollution abatement, Chemical reactions, Liquid wastes, Alkalis, Water purification.

A patent was issued for a method to improve contaminated waste water quality by removing pollutants. An aqueous solution of an alkali metal silicate and a silicate setting agent are mixed with the contaminated waste water to form an earth-like material. This material is pulverized and mixed with the waste water to react with pollutants. After a sufficient mixing time, the water is separated from the pulverized material and pollutants. (Collins-FIRL)
W77-08090

WATER WASTE TREATMENT,

F. A. Fairbanks.
United States Patent 4,011,163. Issued March 8, 1977. Official Gazette of the United States Patent Office, Vol. 956, No. 2, p. 569, March, 1977. 1 fig.

Descriptors: *Patents, Equipment, *Sewage treatment, Sludge digestion, Suspended solids, Sedimentation, Liquid wastes, *Waste water treatment, Treatment, Air.

A patent was issued for a sewage treatment apparatus. The device consists of an outer tank enclosing a mixing chamber with a draft tube for sewage transport to the mixing chamber. An outer draft tube is positioned annularly about the first draft tube, and an inner tank, positioned annularly about the outer draft tube, is below and open to the mixing chamber and acts as a primary settling circuit. There are two annular passageways between the inner tank and the outer wall. A portion of the sewage solids from the primary and secondary settling circuits can be returned to the mixing chamber. The mixing chamber contains a pumping means for the introduction of air into the sewage. There is a digester compartment with a connective means to the primary and secondary settling circuits and a sewage treatment outlet. (Collins-FIRL)
W77-08092

INVESTIGATION OF DYNAMIC PERFORMANCE OF WASTE WATER TREATMENT PLANTS,

Wisconsin Univ.-Madison.
C.-Y. Shih.
PhD Thesis, 1976. 411 p.

Descriptors: *Treatment facilities, *Performance, *Operation and maintenance, Pollution abatement, Model studies, Sewage treatment, Effluents, Separation, Coagulation, Filtration, Waste water treatment.

A study was conducted to determine the time-dependent performance of waste water treatment plants. The stochastic time series approach used here is based on the analysis of large amounts of collected data. Two treatment systems in Wisconsin were studied. Although existing models cannot explain such situations as internal compensating mechanisms for damping out normal diurnal variations in organic loading, this model is able to explain 42-82% of data variations. Comparing the

results from simplistic mechanistic models and stochastic models indicated the importance of this comparison in understanding the advantages and disadvantages of each model type. The performance of final clarifiers was also studied. Indications were that improved solids removal in final clarifiers, rather than improved soluble BOD5 removal in aeration basins, was more important for a higher degree of total system performance. Solids removal efficiency could be upgraded by expanding final clarifiers, adding coagulant aids, or filtering the final effluent. (Collins-FIRL) W77-08094

KINETICS OF BREAKPOINT CHLORINATION AND DISINFECTION,

California Univ., Berkeley.
B. M. Saunier.

PhD Thesis, 1976. 395 p.

Descriptors: *Kinetics, *Chlorination, *Disinfection, Model studies, Chemical reactions, Chlorine, Lime, Municipal wastes, Nitrogen, Coliforms, Waste water treatment, Mathematical models.

A continuous flow pilot plant study was conducted to determine the kinetics of chlorine-ammonia reactions with chlorine added in excess (breakpoint chlorination) and of bacterial disinfection. Significant results were: reaction end products containing nitrogen and a lesser quantity of nitrate; nitrate production which increased directly with initial chlorine/nitrogen dose ratio; trichloride production which was less pH-dependent; and nitrate formation which was slow and not strongly pH-dependent. Nitrogen released from nitrogen trichloride was converted mainly to nitrate in the presence of free chlorine. The initial reacting stream segregation had no substantial effect on breakpoint reaction rates, but had a small effect on nitrate production. HOCl was approximately 30 times more bactericidal than OCl(-). NH2Cl was as bactericidal as HOCl. NH2Cl was practically inert in comparison. The mathematical model developed in this research can compute water pH immediately following chlorine and other chemical application, as well as the production of the aforementioned compounds, and total chlorine, free chlorine, mono-, di-, and trichloramines. Model predictions vary from reality when chlorine/ammonia dose ratio is relatively small or the contact time is short. (Collins-FIRL) W77-08095

ANALYSIS OF ACTIVATED SLUDGE PROCESS PERFORMANCE,

California Univ., Davis.
W. H. Hovey.

PhD Thesis, 1976. 72 p.

Descriptors: *Activated sludge, *Performance, *Treatment facilities, Municipal wastes, Biological properties, Physical properties, Model studies, Economics, Evaluation, Flow, Sewage effluents, Biochemical oxygen demand, Water quality control, Waste water treatment.

A study was conducted to collect and analyze daily data on the performance of activated sludge plants. Linear and multiple regression techniques were used to evaluate effluent quality, effluent quality variation, and effluent quality as a function of flow rate and design flow rate. The predictable variation of effluent quality, when measured by BOD and suspended solids concentrations, can allow the prediction of process performance variations and the development of discharge requirements which are realistically attainable. There were no indications of any effect of process size or process performance, suggesting no real benefit from larger regional facilities insofar as stream water quality control is concerned. The net effect of larger facilities having larger flow rates may even be negative on receiving streams. (Collins-FIRL) W77-08096

MECHANISMS AND KINETIC PARAMETERS IN GRANULAR MEDIA FILTRATION,

California Univ., Berkeley.
M. C. Kavanaugh.

PhD Thesis, 1974. 422 p.

Descriptors: *Kinetics, *Filtration, Model studies, Design criteria, Pilot plants, Separation, Suspended solids, Performance, Waste water treatment, Analytical techniques, Filters.
Identifiers: Granular media filters, Multi-media filters, Upflow filters.

Investigations were conducted to develop a process analysis methodology for particle collection in deep-bed granular media filters for optimum filter process design with minimum pilot plant experiments. Experiments indicated that straining was of small contribution to particle removal for stabilized and destabilized particles if the particle size/medium size ratio was less than .004, and the particle number flux was less than 100,000,000/sq cm/sec. Attachment was thought to be the rate limiting step under all experimental conditions. The three model parameters for a given layer of medium were the amount of solids deposited prior to the onset of effluent quality deterioration, the maximum depth-averaged single collector efficiency, and the first order proportionately constant relating head loss to specific deposit. The method was found to permit estimation of optimum process design, if the parametric dependence of the model parameters is known. (Collins-FIRL) W77-08097

METHOD FOR ELIMINATING ORGANIC AND INORGANIC BOUND NITROGEN FROM DOMESTIC AND INDUSTRIAL WASTE WATER,

Cellulose Attisholz A. G. (Switzerland). (Assignee).

M. Duback, and A. Scherler.
United States Patent 4,011,156. Issued March 8, 1977. Official Gazette of the United States Patent Office, Vol 956, No 2, p 566-567, March, 1977. 1 fig.

Descriptors: *Patents, *Aeration, *Nitrogen, Organic matter, Inorganic compounds, Domestic wastes, Industrial wastes, *Waste water treatment, Water purification, *Denitrification.

A patent was issued for a method to eliminate organic and inorganic bound nitrogen from domestic and industrial waste water. The process involves two stages connected in series which can directly process unclarified waste water in a biological activated sludge treatment plant. Waste water is aerated in the first stage and transferred to the settling basin where a clarified effluent is transferred into the second stage aeration tank and then to the second stage settling basin. Waste water with organic and inorganic bound nitrogen is aerated in the first stage tank and the organic bound nitrogen is ammonified. The ammonified waste water is transferred to the first settling basin and nitrates are denitrified. This effluent is transferred to the second aeration tank where an oxygen level of at least 2 milligrams/liter is provided. Ammonia is nitrified to nitrates in this section and the process is continued by recirculating a portion of the clarified effluent from the second settling basin to the first aeration tank. (Collins-FIRL) W77-08099

WASTE-WATER PROCESS,

Chevron Research Co., San Francisco, Calif. (Assignee).

T. R. Farrell, R. J. Klett, and J. A. Craig.
United States Patent 4,002,565. Issued January 11, 1977. Official Gazette of the United States Patent Office, Vol. 954, No. 2, p 777-778, January, 1977. 1 fig.

Descriptors: *Patents, *Water reuse, *Ammonia, *Acids, *Gases, *Waste water treatment, Separation, Temperature, Equipment, Water purification, Liquid wastes.

A patent was issued for a process to produce recycle water and to separate ammonia and acid gas from waste water. Waste water is passed through an acid gas-ammonia stripping column, which is maintained at a bottoms temperature of 93-149 C and a pressure of 1 to 5 atmospheres absolute, to produce a recycle water stream and an effluent gas stream of acid gas, ammonia, and water vapor. The acid gas and ammonia content is less than 15% of that in the waste water. The two streams are separately withdrawn from the stripper and a liquid aqueous concentrate of ammonia and gas are produced by decreasing the temperature of the gas stream to about 55 to 110 C. The concentrate is passed into a primary acid-gas stripping column, and is maintained at superatmospheric pressure acid-gas stripping conditions to produce an effluent acid-gas stream and an aqueous bottoms stream. The acid-gas stream and the bottoms stream are separately removed from the acid-gas stripping column to produce an effluent gas stream of ammonia, and a second recycle water stream by passing the bottoms stream through an ammonia stripping column. This column is maintained at superatmospheric pressure ammonia stripping conditions. The second stream has an acid gas ammonia content which is 15% less than that of the bottoms stream from the acid-gas stripping column. (Collins-FIRL) W77-08100

5E. Ultimate Disposal Of Wastes

WORKSHOP PROCEEDINGS - RESEARCH NEEDS RELATED TO RECYCLING URBAN WASTEWATER ON LAND,

Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 5D.
W77-07607

RESULTS OF R/V YAQUINA CRUISE YALOC-74, LEG 3: SEABED DISPOSAL PROGRAM, NORTH PACIFIC STUDY AREA MPG-2, 33 DEGREES 20'N, 151 DEGREES 00'W, NOV. 30 - DEC. 21, 1974,

Rhode Island Univ., Kingston. Graduate School of Oceanography.
G. R. Heath.
Available from the National Technical Information Service, Springfield VA 22161 as AD-A013 433. Price codes: A03 in paper copy, A01 in microfiche. Report to U. S. Energy Research and Development Administration and U. S. Office of Naval Research, Ref. No. 75-4, July 1975. 29 p, 14 fig, 2 append. ERDA-E(11-1)-2689 ONR-N00014-67-A-039-0007.

Descriptors: *Radioactive waste disposal, Water pollution sources, Sediments, Geochemistry, Sites, Oceans, Water quality, *Pacific Ocean, Sampling, *Pollutant identification.
Identifiers: *North Pacific Ocean, Geotechnical properties, Sea floor.

During 10 days in the vicinity of 33 degrees 20'N, 151 degrees 00'W (MPG-2 area), three near-bottom current meters were deployed, the bathymetry and sub-bottom acoustic structure of the surrounding seafloor were determined, and sediment cores were collected for studies of artificial radionuclide distribution, geotechnical properties, geochemical properties, and to identify the character of shallow acoustic reflectors. Large volume water samples for artificial radionuclide and suspended sediment were also collected. These samples and data will supplement earlier material to be used in the evaluation of the central North Pacific as a potential site for the ultimate disposal of high-level reactor wastes. (Sinha-OEIS)

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5E—Ultimate Disposal Of Wastes

W77-07739

WASTE MANAGEMENT FOR THE COASTAL ZONE: CONCEPTS FOR THE ASSESSMENT OF OCEAN OUTFALLS,

Assembly of Engineering Marine Board, Washington, D.C.

E. F. Gloyna, N. E. Armstrong, J. C. Geyer, M. Lang, and J. D. Parkhurst.

Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-023 514. Price codes: A03 in paper copy, A01 in microfiche. National Academy of Sciences-National Academy of Engineering Report, March 1976. 33 p, 2 fig, 16 ref, 2 append. ONR-N00014-67-A-0244-0002.

Descriptors: *Waste disposal, *Environmental effects, *Water pollution, Coasts, Water quality control, Federal government, Management.

Identifiers: *Ocean outfalls, *Coastal zone management, Outer Continental Shelf, Waste management.

In 1973 the Marine Board launched the study upon which this report was based in recognition of the need to address questions regarding coastal wastewater management practices and their environmental impacts. The report considers various waste materials now disposed through ocean outfalls, evaluates several waste disposal systems, and assesses federal regulations governing waste disposal. It deals particularly with the rationale for setting federal standards to protect the marine environment. (Sinha-OEIS)

W77-07747

TAR BALL DISTRIBUTION IN THE WESTERN NORTH ATLANTIC,

Coast Guard Research and Development Center, Groton, Conn.

For primary bibliographic entry see Field 5B.

W77-07757

INVENTORY OF BENTHIC ORGANISMS AND PLANKTON AT MOKAPU, OAHU,

Hawaii Univ., Honolulu. Water Resources Research Center.

For primary bibliographic entry see Field 2L.

W77-07798

DISPOSAL OF FEEDLOT WASTES USING A TWO-STAGE PROCESS WITH NET ENERGY PRODUCTION,

Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 5D.

W77-07816

INFLUENCE OF ENVIRONMENTAL FACTORS ON SELECTED AMELIORATION TECHNIQUES FOR DISCHARGES OF HAZARDOUS CHEMICALS,

Battelle Columbus Labs., Ohio.

For primary bibliographic entry see Field 5G.

W77-07828

ESTIMATING COSTS OF WASTE WATER SLUDGE DISPOSAL,

Boyle Engineering Corp., Orlando, Fla.

S. C. Helle.

Public Works, Vol 108, No 3, p 56-58, March, 1977. 5 fig.

Descriptors: *Cost analysis, *Costs, *Sludge disposal, Sludge digestion, Dewatering, Transportation, Capital costs, Maintenance costs, Electric power costs, Operating costs, Wages, Comparative costs, Equipment, Estimated costs.

A procedure for cost estimation of waste water sludge disposal was presented. The analysis was

broken down according to the three phases of sludge disposal: digestion, dewatering, and hauling. Digestion costs included capital investment, power, labor, and maintenance costs. Dewatering expenses consisted of capital, power, labor and maintenance, and chemical costs. Hauling costs were truck purchase and operation, labor costs, and dumping fees. If changes in the sludge disposal operation occur, estimates need be re-analyzed for only that phase which is affected. Estimated parameters for various phase components were input into a series of simple equations to illustrate the computational format for arriving at costs. (Collins-FIRL)

W77-07861

NITRIFICATION IN SOIL TREATED WITH DOMESTIC AND INDUSTRIAL SEWAGE SLUDGE,

Georgia Univ., Experiment. Dept. of Agronomy.

D. O. Wilson.

Environmental Pollution, Vol. 12, p 73-82, 1977. 3 fig, 5 tab, 15 ref.

Descriptors: *Nitrification, *Sludge disposal, Domestic wastes, Industrial wastes, Soil contamination effects, Heavy metals, Lead, Zinc, Cadmium, *Sewage disposal, *Waste water treatment, *Sewage sludge.

Experiments were conducted to determine the effects of two sewage sludges, varying in metal content, on nitrification of $\text{NH}_4(+) - \text{N}$ added to soil. Dried domestic or industrial sewage sludge was applied to soil at rates of 0, 1, 4, or 16 milligrams/gram and the soils were incubated with or without added $\text{NH}_4(+) - \text{N}$ at 30 C. Data was not corrected for nitrification occurring in untreated soil. Domestic sludge had no great effect on $(\text{NO}_3(-) + \text{NO}_2(-) - \text{N})$, except at 16 milligram/gram applications. Industrial sludge at 4 and 16 milligrams/gram substantially reduced the same values when compared to control values during the first few weeks. High application rates of both sludges produced appreciable amounts of $\text{NH}_4(+) - \text{N}$ accumulated at the end of the first week. Industrial sludge reduced nitrification at the two highest rates and, at the highest rate, completely inhibited nitrification during the first two weeks. Domestic sludge had a slight effect on nitrification reduction at the highest rate. The reduced nitrification at high rates of industrial sludge was thought to be caused by zinc, cadmium, and lead. It was concluded that high rates of sewage sludge containing high metals concentrations temporarily inhibit nitrification and that extended use of such sludges may seriously interfere with important microbial nitrogen transformation in soil. (Collins-FIRL)

W77-07862

EFFECTS OF TRACE ELEMENTS ON NITROGEN MINERALIZATION IN SOILS,

Iowa State Univ., Ames. Dept. of Agronomy.

For primary bibliographic entry see Field 5B.

W77-07864

COMMUNITY WATER SUPPLY AND EXCRETA DISPOSAL IN THE DEVELOPING COUNTRIES,

International Reference Centre for Community Water Supply, The Hague (Netherlands).

For primary bibliographic entry see Field 5G.

W77-07865

SILK FROM SOW'S EARS.

For primary bibliographic entry see Field 5D.

W77-07867

SAVE SLUDGE HANDLING COSTS BY LEVEL CONTROL,

Markland Specialty Engineering, Ltd., Toronto (Ontario).

For primary bibliographic entry see Field 5D.

W77-07868

APPLICATION OF SEWAGE SLUDGE TO CROPLAND.

Crops and Soils, Vol 29, No 7, p 5-7, April/May, 1977.

Descriptors: *Sludge disposal, *Soil amendments, Heavy metals, Nutrients, Toxicity, Fertilizers, Vegetation, Phosphorus, Cadmium, Crops, *Soil disposal fields, *Sewage sludge.

A summary was presented of an EPA report, by the Council of Agricultural Science and Technology, on the application of sewage sludge to cropland. Sludge may be a good source of plant nutrients and a good soil conditioner, but the problem of possible heavy metal contamination must be considered. About 25% of sludge is applied to land, but future economic and environmental considerations may increase its application to croplands. With increasing sludge production, industrial pretreatment of waste water could substantially reduce heavy metals in sludge. It has been suggested that the sludge quantity applied be determined by nitrogen, phosphorus, or heavy metal content. Where metal content is low, the nutrient needs of the crops could be the deciding factors. Various recommendations were made for the use of sludges containing cadmium, copper, molybdenum, nickel, and zinc. Parameters of usage included soil pH; metal residence time in soils; and effects on crops, animals, and humans. (Collins-FIRL)

W77-07869

ORGANIC MATTER AND HEAVY METAL UPTAKE,

Oklahoma State Univ., Stillwater. Dept. of Agronomy.

M. B. Kirkham.

Compost Science, Vol. 18, No. 1, p 18-21, January-February, 1977. 57 ref.

Descriptors: *Organic matter, *Heavy metals, Soil chemical properties, *Sludge disposal, Fulvic acids, Humic acids, Hydrogen ion concentration, Copper, Iron, Zinc, Manganese, Molybdenum, Toxicity.

The uptake of the organic matter and heavy metal content of sludge has become increasingly important due to the economically beneficial disposal of sludge for agricultural purposes. The greater portion of heavy metals combined with soil organic matter are insoluble, stable combination with humic substances. The presence of humus in soil is beneficial because it holds heavy elements needed for plant growth for long periods of time and releases them as needed. Deficiencies of these heavy metals are most consistently found in plants grown on peat and muck soils. Low pH causes reduced availability from organic matter relative to the same soil without organic matter; high pH causes this availability to increase. The organic matter degradation rate in soil is dependent on microbial activity. Incubation studies indicated that metal release by sludge decomposition in an alkaline soil did not make these metals available for plant uptake. Other studies indicated that plants grown on soils composted with sludge had much lower cadmium and zinc contents than those grown on plots with digested sludge. Radioisotope studies indicated that organic matter reduces plant uptake of radioisotopes. Sludge was found effective in increasing the organic matter content of soil. Research indicated that the maintenance of a high organic matter content in soil reduces plant uptake of metals added to soils treated with sludge. (Collins-FIRL)

W77-07870

*HYDIG-ONE EXAMPLE OF CONTROLLED SLUDGE USE,

Compost Science, Vol. 18, No. 1, p 30, January-February, 1977.

Descriptors: *Sewage treatment, *Sludge disposal, *Fertilizer, Humus, Nitrogen, Phosphate, Soils, Metals, Trace metals, Organic matter, Soil disposal fields, Waste disposal, *Waste water treatment.
Identifiers: Hydig, Liquid fertilizer.

A sewage treatment plant at Rickmansworth, England, has developed a liquid fertilizer from treated sludge called 'Hydig.' It is distributed to farms in a 300 square mile area around the plant. The treated sludge becomes a fertilizer rich in humus, nitrogen, and phosphate, and it has some potassium. Instructions are provided with the product which emphasize the possible toxicity of heavy metals contained in it. It contains 60.1% of organic and volatile matter, 39.9% mineral matter, 7.84% total nitrogen, and 5.13% phosphorus. Metal content averages 0.0032% for cadmium, 0.0117% for nickel, 0.0392% for chromium, 0.1337% for zinc, and 0.0437% for lead. Various controls are used for the distributed sludge. Each field at every farm is recorded and every dressing and quantity is noted. Soil samples are analyzed before each dressing and sludge is sampled daily from the delivery tanker. (Collins-FIRL)
 W77-07871

COMPOSTING—AN APPROACH TO USING SEWAGE WASTE,
 Bird and Hale Ltd., Toronto (Ontario). Water Management Div.
 J. D. Heaman.
 Compost Science, Vol. 18, No. 1, p 28-29, January-February, 1977.

Descriptors: *Sludge disposal, *Fertilizers, Sludge digestion, Dewatering, Bacteria, *Biological treatment, Temperature, Equipment, Anaerobic conditions, Storage, Organic compounds, Oxidation, Odor, Public health, Nutrients, Nitrogen, Phosphorus, Waste disposal, *Canada.
Identifiers: *Composting.

Composting was considered as a means of using sewage wastes. The City of Windsor, Canada, has contracted with a composting firm to process sludge produced from treatment plants. Water is first removed until there is approximately 30% solids. The sludge is mixed with sawdust, inoculated with starting material, and the blend may then be oxidized to produce a stable humus. The sludge/sawdust ratio is about 80:20 by weight. Bacterial action begins at this point; the mixture is turned to prevent anaerobic conditions. After three months of this treatment, the compost is suitable for farm use. Care must be taken to provide an environment which allows the biochemical processes to continue. Temperatures of nearly 165 F destroy pathogenic bacteria and other unwanted materials. The product is odor-free, non-hazardous to health, and sterile. It is marketed in 10, 25, 50, and 80-pound bags. Blends are marketed as a potting soil, a mixture to improve aeration, and a greenhouse aid. They are also used to improve plant growth and soil fertility. The method is applicable to any waste matter with a substantial organic character for stabilization. (Collins-FIRL)
 W77-07876

A NEW VACUUM SEWAGE SYSTEM BY IFO WARTSILA.
 For primary bibliographic entry see Field 5D.
 W77-07882

GO AHEAD FOR DRAINAGE AND OUTFALL,
 Effluent and Water Treatment Journal, Vol. 17, No. 3, p 112, March, 1977.

Descriptors: *Drainage, *Outfalls, Piping, Monitoring, Waste disposal, Sewage effluents, Bacteria, Saline water, Domestic wastes, Pollution abatement, Environmental control.
Identifiers: *Ocean disposal.

The Wessex Water Authority, in England, has decided to build a proposed drainage and long sea outfall system as the most effective and economical solution for the sewage problems in the Weymouth and Portland areas. A study has been undertaken to select definite siting and outfall length. Conditions in the outfall area will be monitored before and after construction to determine the necessity of pretreatment. Tests are also to be conducted with harmless bacteria to determine the time it takes for them to move from the outfall area back to land. The long sea outfall discharging macerated and screened domestic effluent into deep water is expected to relieve present marine pollution problems. (Collins-FIRL)
 W77-07889

GOLAR RUBBISH, OIL SLUDGE AND SEWAGE INCINERATOR.
 Shipbuilding and Marine Engineering International, Vol. 99, No. 1204, p 680, December, 1976.

Descriptors: *Incineration, Boats, *Waste disposal, Sludge disposal, Equipment, Heat treatment, Sewage treatment, Treatment facilities, Oil wastes, Solid wastes, *Ultimate disposal.
Identifiers: *Golar GS500 incinerator, Marine sanitation.

An incinerator, the Golar GS500, was developed for shipboard wastes. The unit weighs about 4,300 kilograms; it can burn solid wastes up to 75 kilograms/hour, oil sludge at nearly 80 kilograms/hour, depending on water content, sewage at nearly 30 kilograms/hour, or any combination to a maximum of 580 kilowatts. There is a top-mounted oil burner above the combustion chamber, but not in the interconnecting rubbish chamber. Combustion is usually at 1200-1400 C. Pyrolysis in the rubbish chamber, using radiant heat from the combustion chamber, occurs at 400-800 C. The oil burner has two diesel oil burning stages, at 36 and 16 kilograms/hour, with a pressure atomizing and a steam-atomized sludge burner stage. Particles up to an 8 millimeter diameter can be processed, allowing incineration of raw sewage sludge from common treatment facilities. Sewage sludge should be directly pumped into the oil sludge tank to produce a more combustible mixture. No sludge preheating is necessary. Rubbish can be loaded through a feed hatch for distribution to the combustion chamber by a manually-operated rotating sluice. (Collins-FIRL)
 W77-07911

SEWAGE SLUDGE DISPOSAL: A STICKY PROBLEM WITH NO FAIL-SAFE ANSWER,
 C. V. Fluet.
 Solid Wastes Management, Vol. 20, No. 2, p 38, 58-59, February, 1977.

Descriptors: *Sludge disposal, *Sewage disposal, Landfills, Solid wastes, Sludge digestion, Heavy metals, Soil contamination, Food chains, Incineration, Economics, Costs, *Waste water treatment.
Identifiers: Land disposal, Ocean dumping, Soil injection, Composting.

Methods for the disposal of sewage sludge were considered. A well and properly designed landfill can accept sludge. The usual procedure involves combining dewatered sludge, containing no more than 20-30% solids, with solid wastes or soil for bulking. Landfilling is a reasonable alternative disposal method if land is available and is environmentally acceptable. It is also economical but is only a stop-gap solution. Contaminant, leachate, and heavy metals movement present problems with landfilling. Discing, plowing or injecting digested, dewatered sludge on the soil surface and subsurface is another disposal alternative. This allows sludge to be used as an added resource. Using sludge on food crops for humans or animals is problematic because of the heavy metals pollution of the food chain. Bacteria, viruses, and persistent pesticides raise other questions regarding this

disposal method, particularly because of the potential danger to groundwaters. Entrenchment of raw sewage requires substantial land areas and is very costly. Small-scale composting has received some acceptance as a disposal method. Ocean dumping is ruled out because it produces many more pollution and contamination problems. Incineration is another alternative, but produces problems of ash residues with a high metals concentration and it usually involves some land disposal. Choosing one disposal method over another will depend on the relative importance of all factors involved. (Collins-FIRL)
 W77-07948

PREFABRICATED PANELS FOR SUB-SURFACE SEWAGE EFFLUENT AND WASTE WATER DISPOSAL,
 R. W. Johnson.

United States Patent 4,013,559. Issued March 22, 1977. Official Gazette of the United States Patent Office, Vol 956, No 4, p 1380, March, 1977. 1 fig.

Descriptors: *Patents, *Concrete, *Underground disposal, Septic tanks, Sewage disposal, Waste water disposal, Liquid wastes, Construction materials, Ultimate disposal, Disposal.

A patent was issued for prefabricated panels to be used for underground sewage effluent and waste water disposal from septic tanks. There is at least one panel section which includes top, bottom, end, and side walls of a strong, porous cementitious material. Several elongated chambers with an upper, lower, and intermediate chamber, one above the other, are arranged within the section. These are partially separated by a web of the porous cementitious material. A pipe extends from the septic tank into the upper chamber to allow air and waste water to enter the panel section. There is also a means for overflow effluent to move through the separating webs to the lower chambers. (Collins-FIRL)
 W77-08091

INCINERATION METHOD AND SYSTEM,
 Envirotech Corp., Menlo Park, Calif. (Assignee).
 L. A. Lambana, and J. G. Campos.

United States Patent 4,013,023. Issued March 22, 1977. Official Gazette of the United States Patent Office, Vol 956, No 4, p 1202, March, 1977. 1 fig.

Descriptors: *Patents, *Incineration, Equipment, Oxidation, Gases, Oxygen, Sludge disposal, Dewatering, Air, *Waste treatment.
Identifiers: Multiple hearth furnace, Afterburners.

A patent was issued for a method and apparatus for sludge incineration. Dewatered sludge containing organic wastes is incinerated in a multiple hearth furnace equipped with an afterburner for receiving gases and vapors from the furnace. Wastes are pyrolyzed in a regulated oxygen-deficient atmosphere so that the products of the pyrolysis are only partially oxidized. These products are then conveyed in the gases and vapors from the furnace to the afterburner, where enough air is introduced to complete their oxidation. (Collins-FIRL)
 W77-08098

5F. Water Treatment and Quality Alteration

CONCENTRATION OF BACTERIA IN WATER USING THE ULTRAFILTRATION METHOD, (IN FRENCH),
 Institut National de la Sante et de la Recherche Medicale, Villeneuve D'Ascq (France). Ecotoxicol. Microb. Unit.
 For primary bibliographic entry see Field 5D.
 W77-07860

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5F—Water Treatment and Quality Alteration

DIRECT AND INDIRECT WASTE WATER REUSE FOR MUNICIPAL PURPOSES. Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
For primary bibliographic entry see Field 5D.
W77-07866

HOW TO DETERMINE WASTE WATER FLOW. W. S. Foster.
The American City and County, Vol 92, No 3, p 61-62, March, 1977.

Descriptors: *Flow measurement, *Pipe flow, *Monitoring, *Sewers, *Measurement, Data collection, Equipment, Flow rates, Instrumentation, Planning, Water pollution.

A discussion was presented of various aspects of the problem of waste water flow determination. The monitoring equipment should be accurate and operable in wet or dry weather, reasonably priced and easy to install and service, capable of quick and easy installation at various manhole locations, rugged and operable in an automatic mode, reasonably vandal-proof, and should not interfere with the flow in the sewers or with sewer use. Oscillating probes, bubbler tubes, various floats, ultrasonic level detectors, and capacitance measuring probes are used for monitoring purposes. Flow velocity can be measured by using salts or radioactive tracers in the waste water, or by a chemical dilution method using a fluorescent dye. Information derived by these instruments and methods can guide engineers, planners, and administrators in developing abnd improving collection systems. (Collins-FIRL)
W77-07881

TREATING URBAN DRAINAGE AS A UTILITY. Kramer, Chin and Mayo, Inc., Seattle, Wash.
For primary bibliographic entry see Field 5G.
W77-07947

SOME REFLECTIONS OF A SEWAGE WORKS MANAGER. Severn-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 5D.
W77-07952

COMPOSITION AND METHOD OF INHIBITING GROWTH OF SLIME IN WATER. Betz Lab., Inc., Trevose, Pa. (Assignee).
For primary bibliographic entry see Field 5G.
W77-08027

COMPOSITION AND METHOD FOR FLOCCULATING SUSPENDED SOLIDS. Calgon Corp., Pittsburgh, Pa. (Assignee).
For primary bibliographic entry see Field 5D.
W77-08031

5G. Water Quality Control

GLOSSARY OF WATER RESOURCE TERMS. Open Lands Project, Chicago, Ill.
For primary bibliographic entry see Field 10C.
W77-07613

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. SELECTED MAJOR WATER USING INDUSTRIES AND POPULATION PROJECTIONS, APPENDIX III. CH2M/Hill, Corvallis, Oreg.
For primary bibliographic entry see Field 6D.
W77-07624

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. WATER QUALITY CONTROL PROJECTIONS, APPENDIX VI. Oregon State Sanitary Authority, Salem.
Prepared for the Oregon State Water Resources Board, (Salem), June 1969, 216 p, 19 fig, 108 tab.

Descriptors: Water quality, *Water quality control, *Water quality standards, *Oxygenation, *Biological oxygen demand, River basins, Stream flow, *Wastes, *Waste disposal, Hydraulic characteristics, *Projections, *Forecasting, *Irrigation, *Oregon, Municipal wastes, Waste treatment, *Columbia River, *Waste assimilative capacity.
Identifiers: Water turbulence, Recreation coefficient, Cascade Mountains, Coast Range Mountains, Willamette River Basin, Sandy River Basin(OR), Hood River and Fifteenmile Creek Basins(OR), Deschutes River Basin(OR), John Day River Basin(OR), Umatilla, Walla Walla and Willow Creek Basins(OR), Grande Ronde Basin(OR), Powder and Burnt River Basins(OR), Malheur River Basin(OR), Owyhee River Basin(OR), Malheur Lake Basin(OR), Malheur Lake Basin(OR), Goose and Summer Lakes Basin(OR), Klamath River Basin(OR), Rogue River Basin(OR), Umpqua Basin(OR), South Coast Basin(OR), Mid Coast Basin(OR), North Coast Basin(OR), *Snake River(OR).

Water quality control projections are presented for 20 river basins in Oregon. Descriptions of the condition of the receiving streams under present flow and loading conditions serve as a reference when analyzed against the framework of present and 'ultimate' development conditions. Levels of biological oxygen demand (BOD) are used as a convenient, general water quality parameter. Projections of the quality of return flows are based on projected per capita water use by month, the present production of oxygen-demanding wastes from the most efficient industrial processes now in use, and the number of times water has been reused in irrigation before entering the stream. A large variation in assimilative capacity required two sets of water quality objectives: a seasonal minimum of 85% of saturation for free flowing streams east of the Cascades, and 90% for streams west of the Coast Range. Estimates of the reaeration coefficient for each reach were developed from stream gradient data at a known flow, and cross section data. The total assimilative capacity is estimated by correlating variability of channel conditions with distance. An oxygen balance solution was computed for the year 2020 and 'ultimate development' and offered as streamflow requirements for each reach and each of 12 projected months. (Gentry-NC)
W77-07626

A LAND USE DECISION METHODOLOGY FOR ENVIRONMENTAL CONTROL. Rocky Mountain Center on Environment, Denver, Colo.
For primary bibliographic entry see Field 6G.
W77-07629

ENVIRONMENTAL GEOLOGIC ASPECTS OF PLANNING, CONSTRUCTING, AND REGULATING RECREATIONAL LAND DEVELOPMENTS. Wisconsin Dept. of Administration, Madison. State Planning Office.
For primary bibliographic entry see Field 6G.
W77-07630

ENVIRONMENT AND REGIONAL PLANNING, A PILOT STUDY OF THE COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY. NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
For primary bibliographic entry see Field 6G.
W77-07633

EXPERIENCE OF THE PAVLODAR OBLAST PUBLIC HEALTH SERVICE IN SANITARY PROTECTION OF THE IRTYSH RIVER, (IN RUSSIAN). V. V. Popov, P. E. Li, Y. S. Kalinin, I. I. Sain, and E. V. Sveshnikova.
Gig Sanit 5, p 98-100, 1976.

Descriptors: Public health, Rivers, Water quality control, Pollution abatement, Bacteria, Bacteriology, Ecoli, Microorganisms, Water pollution, Regulation, Sewage.
Identifiers: *Irtys River(Kazakh-SSR), USSR.

Efforts to improve the sanitary condition of the middle course of the Irtys River (Kazakh SSR, USSR) since the 1958 implementation of the Bukhtarma dam are reviewed. Active physical, chemical and bacteriological research, regulation of annual water flow, reduction of sewage inflow and water-protective construction resulted in arresting the further deterioration of water quality; indicators of microbe numbers and titer of *Escherichia coli* show the Irtys to be still significantly polluted. Further measures are proposed, including curtailment of dumping partially treated sewage water from Pavlodar and other industrial sewage, better construction of shoreline population centers and farms, prevention of pollution from river shipping and strengthened sanitary measures further upstream.—Copyright 1977, Biological Abstracts, Inc.
W77-07686

LAW, RULES, AND REGULATIONS PERTAINING TO GROUNDWATER IN NEBRASKA. Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 4B.
W77-07695

EXPERIMENTAL DATA FOR THE HYGIENIC STANDARDIZATION OF DIPHENYLAMINE AND DIPHENYLDIETHYLUREA IN WATER BODIES, (IN RUSSIAN). Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene. A. A. Korolev, M. V. Arsen'eva, B. R. Vitbitskaya, T. A. Zakharova, and A. S. Kinzirskaia.
Gig Sanit 5, p 21-25, 1976.

Descriptors: *Lethal limit, *Water quality standards, *Ureas, *Organic compounds, Toxicity, Rodents, Water pollution, Public health.
Identifiers: *Amines.

The investigated substances affect mainly the CNS, the liver and the blood (of rats). The changes noted are typical for an intoxication with nitro-amino compounds. In the doses tested they had no effect on reproduction and no allergic action. The maximal permissible concentration of DPDEU (diphenyl-diethylurea) and DPA (diphenylamine) in water bodies are set at a level of 0.5 and 0.05 mg/l, respectively.—Copyright 1977, Biological Abstracts, Inc.
W77-07700

RISK OF DRINKING WATER CONTAMINATION IN RURAL TENNESSEE. Tennessee Univ., Knoxville. Dept. of Agricultural Economics and Rural Sociology. R. H. Orr, B. R. McManus, and D. O. Baxter.
Tennessee Farm and Home Science, Vol. 100, p 10-13, December, 1976. 3 tab, 7 ref.

Descriptors: *Rural areas, *Water pollution sources, *Social aspects, Water quality, Water analysis, Septic tanks, *Tennessee, *Potable water, Water supply, Domestic water.
Identifiers: *Fecal contamination.

Recent evidence has indicated that fecal contamination is prevalent in individual water supplies

in rural Tennessee. A study of 1652 homes in 68 rural counties was undertaken in an attempt to more accurately assess the risk of contamination and uncover social factors of the problem. 21 percent of the respondents indicated that their household water supplies come from easily contaminated shallow sources (streams, ponds, dug wells) while only 12.1 percent subscribed to rural water systems, the safest possible source due to routine inspection; the remainder used water from drilled wells. One third of the respondents had neither sewage system nor septic tank. Although free water testing is available throughout the state, fewer than 15 percent of the respondents had ever had their water analyzed. Generally, the higher the educational and employment status of those contacted, the lower the risk of contamination of water supply. Higher risk situations were more likely to occur in East Tennessee than Middle or West Tennessee, and with black families or people over 65. Extensive testing, water quality education, and funding for water system improvements are recommended to alleviate these pollution hazards. (Eberle-NWWA)
W77-07701

ELIMINATING IRON-BEARING WATER FROM WELL NO. 7, Ottawa City Engineers Office, Ill. B. Krause.

Journal of the American Water Works Association, Vol. 69, No. 3, p 146-177, March, 1977.

Descriptors: *Iron, *Rehabilitation, Wells, Pumping, Well casings, Linings, Aquifers, Water pollution sources, Water pollution control, *Illinois, Water wells.

Identifiers: Ottawa(Illinois), *Abandoned wells(Sealing), *Iron-Bearing water, *Well sealing.

An effort to eliminate the iron problem in Well No. 7 in the Ottawa, Illinois water system was undertaken when it was determined that abandonment of the well was logistically and economically unfeasible. Television camera inspection of the borehole revealed cracks and crevices immediately below the 12-inch casing, possibly providing an avenue for iron-bearing water from shallow aquifers to the deeper water supply source. When installation of a 10-inch liner and pumping to waste failed to solve the problem, nearby abandoned wells were investigated and subsequently found to be the source of iron contamination. Proper sealing of these wells reduced the concentration of iron in Well No. 7 considerably, but not to the 0.3 mg/l level the City had hoped. At present, a new well is being used to meet water supply demand, and additional experimentation with the rehabilitation of Well No. 7 has been postponed indefinitely. (Eberle-NWWA)
W77-07702

SALTWATER-FRESHWATER INTERFACES IN THE '2,000-' AND '2,800-FOOT' SANDS IN THE CAPITAL AREA GROUND WATER CONSERVATION DISTRICT, Louisiana Capital-Area Ground Water Conservation Commission, Baton Rouge. For primary bibliographic entry see Field 4B. W77-07703

AN ANALYSIS OF THE FEASIBILITY OF USING AIR AGITATION TO REDUCE GAS SATURATIONS IN SEA WATER AT PILGRIM NUCLEAR POWER STATION,
Yankee Atomic Electric Co., Westborough Mass. Environmental Sciences Group.
M. H. Krabach, and R. A. Marcelllo, Jr.
Prepared for Boston Edison Company, Boston, Massachusetts, July 1976. Report IYAE-1109, 32 p., 2 tab., 25 *Mortalities, Sea water, Water quality, Cooling water, *Operating costs, *Capital costs, Waste disposal, Labor fig., 8 ref.

Descriptors: Laboratory studies, *Supersaturation, *Atmospheric gas, Fish disease, atory tests, *Methodology, Diffusion, Oxygen.
Identifiers: New England aquarium, *Air diffusers, *Nitrogen saturation values, Pilgrim station, *Bubbler de-aeration systems, *Gas bubble disease.

Feasibility studies on the application of a bubbler de-aeration system to reduce discharge gas saturations to an acceptable level so as to prevent or minimize the occurrence of gas bubble disease mortalities of menhaden at Pilgrim Station were conducted. Experimental results indicated that gas supersaturated seawater can be degassed by using an air bubbler system and the application of the concept for de-aeration of the Pilgrim Unit I and II combined circulating cooling water discharge was judged technically feasible. Capital and operating costs for a Pilgrim Station air bubbler were estimated. (Katz)
W77-07720

TROUT AND SALMON CULTURE (HATCHERY METHODS) HATCHERY WATER SUPPLY, California State Dept. of Fish and Game, Sacramento.

E. Leitritz, and R. C. Lewis.
In: Fish Bulletin 164, 1976, p 9-19, 2 tab., 2 fig.

Descriptors: *Oxygen, *Nitrogen, Water quality, *Aquiculture, *Fish hatcheries, *Salmon, *Trout, *Water supply, Supersaturation, Wells, Supersaturation, California, *Aeration, Juvenile fish.
Identifiers: California fish hatcheries, *Hatchery water supplies.

A brief discussion is presented of the water quality requirements suitable for the hatchery production of salmon and trout. Chemical characteristics discussed are dissolved oxygen, carbon dioxide, alkalinity, pH, total dissolved solids, heavy metals, and hatchery treatment methods. Of particular interest in regard to gas supersaturation are photographs of devices used in California hatcheries to remedy oxygen deficient waters and to remove excess nitrogen gases from well water supplies. (Katz)
W77-07726

OIL SPILL AT DECEPTION BAY, HUDSON STRAIT, Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. R. O. Ramseler, G. S. Gantcheff, and L. Colby. Water Resources Branch, Scientific Series No. 29, 1973, 60 p., 19 fig., 10 tab, 10 ref, 7 append.

Descriptors: *Oil spills, *Ice, *Permafrost, Gasoline, Avalanches, Diurnal, Tides, Thawing, Water levels, Sea ice, Bays, *Canada, Waste disposal, Water pollution control, Environmental effects.
Identifiers: *Deception Bay, Hudson Strait, Marine environments, Land environment, Diesel oil, Oil cleanup, Tank farms.

Approximately 427,000 gallons of Arctic diesel oil and gasoline were spilled over permafrost and sea ice at Deception Bay, Quebec, when a tank farm was destroyed by a slush avalanche. A team was organized to study the spill and the objectives of this team were: 1) To discover the cause of the spill; 2) to study the interaction of oil with ice and permafrost; 3) to study the ecological effects of the spill, and 4) to advise on the clean-up and disposal of the spilled oil. Conclusions and Recommendations were: Important fundamental differences exist in the general behavior, spreading and dispersion mechanisms of oil in ice-infested waters as compared to oil in ice-free water. In the present case the ice was static except for its rise and fall due to the tides. This was a great advantage in solving the major problem of containment. Prevailing winds were also advantageous

since they drove the oil towards the natural ice booms where it could easily be pumped and then burned. The procedures used to deal with pollution in open waters could easily be modified and adapted for use in ice-infested regions of the Arctic. More care should be taken in the selection of sites since many phenomena occurring in remote regions are not of general knowledge. Engineers and scientists should be consulted in the site selection and planning stage. Some additional basic and applied research would provide a better understanding of and ability to control the behavior of oil in subzero climates. This would in turn, permit a faster and more effective prevention of any damage in the Arctic. (WATDOC)
W77-07731

MANGROVE ECOLOGY AND DELTAIC-ESTUARINE GEOMORPHOLOGY: CAMBRIDGE GULF-ORD RIVER, WESTERN AUSTRALIA, Louisiana State Univ., Baton Rouge. Center for Wetlands Resources. For primary bibliographic entry see Field 2L. W77-07738

CHARACTERISTICS OF THE AREAS IN WHICH FAST CURRENT OIL CONTROL IS NEEDED,

Coast Guard, Washington, D.C. Pollution Prevention Projects Branch.
W. F. Hammer, C. W. Koburger, and D. S. Jensen. Available from the National Technical Information Service, Springfield, VA 22161 as AD/A-000 452 A06 in paper copy A01 in microfiche. Coast Guard Office of Research and Development, Final Report No. CG-D-103-74, November 1973. 101 p, 7 fig, 38 ref, 6 append.

Descriptors: *Oil spills, *Water pollution effects, *Currents(Water), *Water pollution control, Oil pollution, Great Lakes, Atlantic Ocean, Pacific Ocean, Gulf of Mexico.
Identifiers: Environmental conditions.

Present oil spill control measures are effective only in currents up to between 0.8 and 1.0 knot, depending on the characteristics of the oil and ocean conditions. There are, however, a number of high oil pollution risk areas in which faster currents prevail, or where it is desirable to tow control equipment at higher speeds. The Atlantic, Pacific and Gulf Coasts, the Inland Area, and the Great Lakes were examined. Forty-four high risk areas were located, determined on the basis of a composite of oil concentration and spill frequency. These included inland rivers (12), open rivers (13), bays (5), channels (5), harbors (4), canals (3), and intracoastal waterways (2). Their specific environmental characteristics—current, tide, water and air temperature, wave heights, and wind—are identified, discussed and analyzed. From this, the necessary environmental performance characteristics of fast current oil spill control systems are described, in relation to their expected use. (Sinha-OEIS)
W77-07741

WASTE MANAGEMENT FOR THE COASTAL ZONE: CONCEPTS FOR THE ASSESSMENT OF OCEAN OUTFALLS, Assembly of Engineering Marine Board, Washington, D.C. For primary bibliographic entry see Field 5E. W77-07747

PETROLEUM OIL DETECTION BUOY SYSTEM,
Spectrogram Corp., North Haven, Conn.
For primary bibliographic entry see Field 5A.
W77-07750

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

HIERARCHICAL MODELING FOR THE PLANNING AND MANAGEMENT OF A TOTAL REGIONAL WATER RESOURCE SYSTEM: JOINT CONSIDERATION OF THE SUPPLY AND QUALITY OF GROUND AND SURFACE WATER RESOURCES,
Case Western Reserve Univ., Cleveland, Ohio.
Dept. of Systems Engineering.
For primary bibliographic entry see Field 4B.
W77-07793

CITIZEN ATTITUDES TOWARD MANAGEMENT OF THE CHESAPEAKE BAY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W77-07796

DEGRADATION OF SODIUM DODECYLSULFATE BY BACTERIA IN WASTE WATERS, (IN RUSSIAN),
Akademiya Nauk USSR, Kiev. Inst. of Colloidal Chemistry and Water.
For primary bibliographic entry see Field 5B.
W77-07801

RESIDUES OF EMULSIFIED XYLENE IN AQUATIC WEED CONTROL AND THEIR IMPACT ON RAINBOW TROUT, SALMO GAIARDNERI,
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
D. F. Walsh, J. G. Armstrong, T. R. Bartley, H. A. Salzman, and P. A. Frank.
Report REC-ERC-76-11, January 1977. 15 p, 10 fig, 6 tab, 19 ref.

Descriptors: *Emulsifiers, Aquatic weeds, *Herbicides, *Aquatic weed control, *Irrigation canals, Fish, Mortality, *Dispersion, Environment, Water quality, Ecosystems, *Rainbow trout, Water pollution effects.
Identifiers: *Xylene.

Emulsified xylene is used to control aquatic weeds in irrigation systems which may occasionally return irrigation water to aquatic habitats that maintain trout populations. Laboratory studies were conducted to determine effects of xylene on rainbow trout, *Salmo gairdneri*, and to measure dissipation of xylene residues in irrigation waters as treated water flowed through canals, irrigated fields, and into return flows. Rainbow trout exposed to emulsified xylene for 2 hours survived a concentration of 7.1 p/m (parts per million), but suffered 100 percent mortality at 16.1 p/m. An off-flavor was produced in fillets of rainbow trout after exposure to 7.1 p/m of xylene for 2 hours, or to 0.36 p/m for 56 days, and was dependent on concentration and exposure. Residues of xylene in fillets of rainbow trout and off-flavor was directly related. Xylene dissipated downstream in irrigation canals, from treatment concentrations of 548 to 760 p/m to an average concentration of 100 p/m or below after the water traveled 10 miles. Xylene residues dissipated in treated irrigated field waters during furrow irrigation from 150 p/m at the head ditch to less than 0.2 p/m in return flows. The xylene residues entering aquatic habitats in return flows from irrigated fields should not seriously affect fisheries or other segments of the aquatic environment. (Bur Reclam)
W77-07805

THE ARGO MERCHANT OIL SPILL. A PRELIMINARY SCIENTIFIC REPORT,
National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
For primary bibliographic entry see Field 5C.
W77-07807

A REVIEW AND EVALUATION OF BASIC TECHNIQUES FOR PREDICTING THE BEHAVIOR OF SURFACE OIL SLICKS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 5B.
W77-07808

A DECISION SUPPORT SYSTEM FOR AREA-WIDE QUALITY PLANNING,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07810

EXTENSIONS AND CORRECTIONS FOR THE CODASYL APPROACH TO DATA BASE MANAGEMENT,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07811

IMPLEMENTATION OF A DECISION SUPPORT FOR REGIONAL WATER QUALITY PLANNING,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07812

INFORMATION TRANSFERRAL WITHIN A DISTRIBUTED DATA BASE VIA A GENERALIZED MAPPING LANGUAGE,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07813

MODELING NONPOINT POLLUTION FROM THE LAND SURFACE,
Hydrocomp Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5B.
W77-07818

INVESTIGATION OF ACID MINE DRAINAGE EFFECTS ON RESERVOIR FISHERY POPULATIONS,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5C.
W77-07827

INFLUENCE OF ENVIRONMENTAL FACTORS ON SELECTED AMELIORATION TECHNIQUES FOR DISCHARGES OF HAZARDOUS CHEMICALS,
Battelle Columbus Labs., Ohio.
S. Srinivasan, T. Thomas, A. Gezen, A. Coyle, and C. Kimm.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-011 213. Price codes: A02 in paper copy, A01 in microfiche. Department of Transportation, U.S. Coast Guard, Report No. CG-D-81-75, February 1975. 109 p, 31 tab, 9 fig, 15 ref, 2 append.

Descriptors: Environment, *Environmental effects, *Hazards, Chemical properties, *Chemical wastes, Discharge(Water), Water pollution, *Water pollution sources, *Water pollution control, Water quality control, Water pollution treatment, Model studies, Floating, *Industrial wastes, Cryogenics.
Identifiers: *Hazardous chemicals, *Amelioration techniques, *Hazardous substances, Spills, Size of spills, Case studies, Model case studies, Floating chemicals, Cryogens.

The influence of environmental conditions on selected potential amelioration techniques for

discharges of selected hazardous chemicals was determined. Historical discharge data was examined to establish categories of spill sizes. The range of environmental conditions (air and water) encountered in discharge situations was determined. Model case studies were performed to assess the magnitude of dispersion in air and/or water. Evaluations were then made to determine if and to what extent the selected amelioration techniques would be influenced by the pertinent environmental conditions. Favorable environmental conditions were also summarized. (Katz)
W77-07828

MATHEMATICAL PROGRAMMING WITHIN THE CONTEXT OF A GENERALIZED DATA BASE MANAGEMENT SYSTEM,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W77-07850

GERMAN POLLUTION CONTROL,
Environmental Science and Technology, Vol. 11, No. 2, p 134-136, February, 1977. 1 tab.

Descriptors: *Water pollution control, *Water quality control, Water quality standards, Industrial wastes, Domestic waste, Municipal wastes, *Waste water treatment, Sewage treatment, Sludge treatment, Water purification, Treatment facilities, Waste disposal, Planning, Legislation.
Identifiers: *West Germany.

A review was presented of West German efforts in water pollution control. The nation enacted a Water Resources Act in 1957, but there is no national standard for surface water quality. The government is able to establish effluent discharge standards and, in the next years, German industry will have to produce more effective effluent treatment. Sewage treatment mainly consists of the mechanical removal of suspended solids and the oxidation of dissolved solids by bacteria and other organisms. Presently, 50% of all waste water is receiving inadequate treatment or is not being purified at all. Only about 30% receives full biological treatment, but by 1985, 90% of all households are expected to be connected to biological treatment plants. There are nearly 6,000 treatment plants for about 40% of the population. If the proposed programs are instituted by 1985, 38-40 million cubic meters of sludge will have to be disposed of annually. Dewatering, drying, incineration, and pyrolysis are being considered and developed for disposal purposes. Advanced treatment processes, including physical-chemical treatment and combinations of these with biological treatment, are being included in treatment schemes to handle industrial wastes. The government is also progressing in matters of air, noise, and thermal pollution, as well as resource recycling and recovery. (Collins-FIRL)
W77-07863

COMMUNITY WATER SUPPLY AND EXCRETA DISPOSAL IN THE DEVELOPING COUNTRIES,
International Reference Centre for Community Water Supply, The Hague (Netherlands).
D. V. Subrahmanyam.
Ambio, Vol 6, No 1, p 51-54, 1977. 2 fig, 2 tab, 8 ref.

Descriptors: *Water quality control, *Planning, Disposal, Rural areas, *Urban areas, Costs, Social change, Social aspects, *Waste disposal, Sewerage, Design criteria, *Water supply.
Identifiers: *United Nations Conference on Human Settlements.

The provision of a safe water supply and hygienic waste disposal for developing nations was considered. HABITAT, the United Nations Conference on Human Settlements, proposed that

each nation set reasonable standards for achieving these goals. Fifty-seven percent of the urban population had a community water supply to house connections and an added 20% had access to piped water from public standposts. As of 1970, about 50% of these piped supplies were intermittent, causing the associated health hazards. For rural areas about 22% of the population had access to safe water. Nearly 75% of urban dwellers had access to public sewerage systems and only 15% of rural residents had similar provisions. The social and economic aspects of the problem were not covered by this WHO survey. One reason was the lack of definitive information, itself a product of underdevelopment. WHO set target goals for 1980 and HABITAT set goals for 1990. Water supply goals would call for more than a 150% increase in spending; WHO disposal goals would require a 200% increase; HABITAT's plan would require a 400% increase over 1975 cost levels. Development strategies for developing countries would include national commitment, manpower development, appropriate design criteria and technology, consultation with an participation of communities; and appropriate institutional mechanisms. (Collins-FIRL)

W77-07865

WASTE WATER PLANTS USE LESS INSTRUMENTATION THAN RELATED INDUSTRIES, Raytheon Co., Portsmouth, R.I.

For primary bibliographic entry see Field 5D.
W77-07872

FINANCING: THERE MUST BE A BETTER WAY.

Quad-City Solid Wastes Committee, Paterson, N.J.
S. A. Lubetkin.
Water and Wastes Engineering, Vol. 14, No. 4, p 80, 82, 85, April, 1977.

Descriptors: *Financing, *Legislation, Loans, Government finance, Interest, Costs, Bond issues, Credit, Grants, *Treatment facilities, Waste water treatment.
Identifiers: Federal Financing Bank, Municipal bonds.

Ideas were presented for better financing arrangements by the government for the construction of waste water systems. An Environmental Financing Authority was created in 1972 when P.L. 92-500 was enacted. Rates were very high and borrowing was low or nonexistent. When money was 'tight' and the New York City crisis made municipal borrowing difficult, legislation was enacted which granted agencies the right to borrow from the Federal Financing Bank when they could not fund their share of eligible grants. The Bank coordinated loan programs with the government's economic and fiscal policies to reduce the costs of federally assisted borrowing. The EPA was required to guarantee payment to the FFB. Rates were the prime issue of discussion. Recommendations were suggested which would tie rate charges to the status of Treasury Securities, the Moody ratings of municipalities, and Standard and Poor ratings. It was also stated that the arrangement of temporary financing should not make a borrower ineligible for Federal loans. (Collins-FIRL)

W77-07873

APPRAISAL OF AREAWIDE WASTE WATER PLANNING.

Water Resources Engineers, Inc., Springfield, Va.
R. P. Shubinski, and W. N. Fitch.
Journal of the Water Resources Planning and Management Division-ASCE, Vol. 103, No. WR1, p 63-72, May, 1977. 2 fig.

Descriptors: *Planning, Water resources, *Legislation, *Coordination, *Water resources development, Water quality control, Water quality standards, Institutional constraints, Administra-

tion, Long-term planning, Pollutant identification, Regulation, Construction, Analysis, Data collection, Waste water treatment, Costs, Project planning.
Identifiers: P.L. 92-500(Section 208).

Basic water and planning demands created by P.L. 92-500 were discussed. Three areas were provided for: basin planning (Section 308), facilities planning (Section 201), and area-wide planning (Section 208). This study concerns area-wide planning which has multiple purposes. Municipal and industrial treatment needs, including storm runoff systems can be identified, and construction priorities can be developed. Regulatory programs can be established and the responsible agencies can be identified, along with the requirements for implementation. Plans and controls for agricultural and forestry nonpoint pollution sources, for mining-related sources, construction-related sources, and for saltwater intrusion can be identified, and residuals and land and subsurface dispositions can be controlled. Carrying out the planning process has encountered some difficulties which have altered the actual sequence of planning from that of the enabling legislation. The goals which were set for 1977, 1983, and 1985 require sharp departures from past attitudes and vast advances in technology. Technical limitations include an insufficient data base, inadequate analytical techniques, shortages of qualified manpower, and a restricted understanding of side effects. Management limitations center on the identification of public goals, jurisdictional conflicts, cost distribution equity, and problems of present institutional structures and the distribution of new powers. The program was judged quite valuable, with all the various conflicts and problems, in advancing water quality planning and may be viewed as a valid approach. (Collins-FIRL)

W77-07874

COMPOSTING—AN APPROACH TO USING SEWAGE WASTE.

Bird and Hale Ltd., Toronto (Ontario). Water Management Div.
For primary bibliographic entry see Field 5E.
W77-07876

SURVEY PREDICTS 33 PERCENT MUNICIPAL COMPLIANCE WITH 1977 DEADLINE.

S. J. Hadeed.
Journal Water Pollution Control Federation, Vol. 49, No. 3, p 360-362, March, 1977. 1 fig, 2 tab.

Descriptors: *Treatment facilities, *Cities, *Water quality standards, Environmental sanitation, Municipal wastes, Water purification, Pollution abatement, Regional analysis, Sewage effluents, Law enforcement, *Waste water treatment, *Water pollution control.
Identifiers: Public law 92-500.

A survey was undertaken to determine the number of municipal treatment facilities which would meet the secondary treatment requirements of Public Law 92-500 by the 1977 deadline. It was indicated that only 33% of the municipal facilities would be able to comply with the standards, as compared to a nearly 90% industrial compliance. A regional analysis of 12,806 facilities found only 4,244 which are either providing this level of treatment or are capable of meeting the deadline. Parameters of the analysis were facilities, sewerage flow, and population served which would have the secondary treatment by the deadline date. In order to provide some impetus without penalty, the EPA will issue Enforcement Compliance Schedule Letters which will forego penalties if certain goals are met by specified dates. However, no extension would last beyond 24 months after the deadline. Municipal dischargers will have to document their need for extensions and provide schemes for compliance within the shortest possible time. Congress is considering legislation to cope with this problem. (Collins-FIRL)

W77-07877

1976 NEEDS SURVEY MARKEDLY LOWER, P. J. Kendrick.

Journal Water Pollution Control Federation, Vol. 49, No. 3, p 365-368, March, 1977. 2 tab.

Descriptors: *Treatment facilities, *Federal Water Pollution Control Act, *Water quality standards, Regional analysis, Construction, Municipal wastes, Cities, Law enforcement, Water purification, Costs, Waste water treatment.

The EPA released its 1976 Needs Survey in February, 1977. Contained in this report was an estimate that \$96 billion would be needed to build facilities in Categories I to V which would meet 1983 municipal effluent standards of the 1972 Federal Water Pollution Control Act. This is \$55 billion lower than the 1974 estimate and reflects improved estimation processes. Costs for storm water pollution control were not included. This would add another \$54 billion. Other reasons for this difference in estimates include: varied assumptions and less structured methodology in 1974, improved guidance procedures in 1976, more accurate 1976 estimates, completion of infiltration/inflow studies, the elimination of needs for controls of infiltration/inflow pollution into combined sewers, the elimination of non-documented state costs, more accurate reporting techniques, and reductions in sewer construction cost estimates for completed work. Independent surveys were conducted in some categories and a section on backlog costs was included. The 1978 survey will include further revisions. (Collins-FIRL)

W77-07878

LAKES WILL TAKE THE POLLUTION LOAD OFF OLD FATHER TAME.

J. Pullin.
Surveyor, Vol. 148, No. 4410, p 7-9, December, 1976. 2 fig.

Descriptors: *Lakes, *Rivers, *Water purification, *Water quality control, Pollution abatement, Water pollution effects, Water pollution control, Biochemical oxygen demand, Urban runoff, Suspended solids, Separation, Sedimentation, Pilot plants, Costs, Planning.
Identifiers: Tame River(England).

A system of lakes was proposed to eliminate the pollution problem of the river Tame, near Birmingham, England. The river is one of the most polluted in England; 86% of the flow, at one point, is effluent from a sewage treatment facility. Urban runoff from the Birmingham area greatly contributes to the problem. Situating some of the lakes at the sites of former gravel workings was seen as to providing benefits including improvement in river water quality at all flows, but especially at high flows; providing a form of tertiary treatment for sewage effluents; providing a diluting buffer for the downstream against accidental upstream pollutions; restoring fisheries in the river; providing recreation and amenity facilities; and potentially improving management of river water. A preliminary testing with a simulated scale lake indicated a reduction of suspended solids from 59 milligrams/liter to 35 and 15 milligrams/liter in winter and from 60 to 31 milligrams/liter in summer. BOD reductions were similarly impressive. Tests showed that lake one would reduce normal flow suspended solids by about 50% and storm flow suspended solids by about 75%. The completed system would dramatically reduce the pollution of the river. However, costs and financing are major problems. The first lake and related treatment facility will cost an estimated 5.9 million pounds. Evaluations will be made after completion of the project to determine the necessity of further construction. (Collins-FIRL)

W77-07913

RELATIONSHIP BETWEEN BOD5 AND FATS, OILS AND GREASE.

Environmental Protection Agency, Springfield, Ill.
D. J. Schaeffer, J. B. Park, and T. Stock.

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

Water and Sewage Works, Vol. 124, No. 3, p 82-83, March, 1977. 3 tab, 8 ref.

Descriptors: *Analysis, *Monitoring, *Oil wastes, *Lipids, *Biochemical oxygen demand, Regulation, Water quality standards, Sewage effluents, Industrial wastes, Domestic wastes, Dissolved oxygen, Mathematical models, Model studies, Treatment facilities, *Waste water treatment, Sewers, Maintenance, *Illinois.
Identifiers: *Grease, BOD5.

Fats, oils, and grease (FOG) have been investigated in Illinois effluent discharges for the purpose of setting regulations. These substances may cause clogging of sewer systems, creating maintenance problems, and they may impede treatment processes. In addition, they may cause sheens, surface and sediment deposits, and produce long term BOD which depletes dissolved oxygen in streams. It was hoped that a linear relationship could be established between FOG and BOD5. Parameters of the defining line were used to calculate the expected BOD5/FOG ratio to obtain FOG limits so that BOD5 would be the limiting factor for readily degraded wastes. FOG limits would be reached first for slowly oxidizing wastes or those which oxidize at extreme receiving stream conditions. Data resulting from investigations revealed the existence of significant relations for the parameters. The amount of BOD5 attributable to FOG could not be inferred from the results, but BOD5 did increase linearly with FOG values. There was appreciable scatter about the regression line. There was no difference between regression lines for industrial and sewage treatment plant effluents. It was concluded that neither BOD5 nor FOG would be sufficient as a single parameter. A dual standard, using BOD5 limits for degradable FOG and FOG concentrations for poorly oxidizable wastes, was suggested. (Collins-FIRL)
W77-07925

COST OF HIGH QUALITY WASTE WATER TREATMENT FOR REUSE,
Envirotech Corp., Salt Lake City, Utah. Eimco BSP Div.

For primary bibliographic entry see Field 5D.
W77-07930

DRAINAGE—WHO PAYS, RESPONSIBILITIES AFTER THE 1973 WATER ACT,
Welsh National Water Development Authority, Cardiff. Dee and Clwyd Sewage Div.
J. Davies, and R. E. Dixon.
Chartered Municipal Engineer, Vol. 104, No. 3, p 35-38, March, 1977. 1 fig, 4 ref.

Descriptors: *Drainage, *Sewers, *Cost, *Sewer construction, Municipal wastes, Domestic wastes, Legislation, Capital costs, Water quality control, *Water treatment.
Identifiers: *Wales.

The English 1973 Water Act places the responsibility for sewerage on various water authorities and other agencies. There is a provision in the Act stating that owners or occupiers of a property, or local authorities, can requisition sewer systems for domestic purposes. The increasing costs of sewer construction present a financing problem: who is to pay for the installations. Water authorities seem likely to have funds for only essential sewer construction in the foreseeable future and will probably concentrate on making the best use of already existing facilities. There is no absolute duty for them to provide sewers for their areas. The requisitioning provision of the Water Act appears to be a useful instrument, since the requisitioner will guarantee the authority's income in uneconomical situations. (Collins-FIRL)
W77-07932

1776-1976: NOTES ON WATER QUALITY PLANNING,
Hydrocomp, Inc., Palo Alto, Calif.

D. L. Hey, and W. H. Waggy.
Simulation Network Newsletter, Vol 8, No 7, p 1-7, November, 1976. 20 ref.

Descriptors: *Water quality control, *Planning, *History, Cities, Rural areas, Domestic water, Waste water, Disposal, Waste treatment, Waste water treatment, Industrial wastes, Domestic wastes, Municipal wastes, Groundwater, Runoff, Filtration, Treatment facilities, Tertiary treatment, Legislation, Water resources, Sewerage, Diseases.

Water quality planning in the United States was chronicled from 1776 to 1976. The urban concentration of the American population has risen from about 5% in 1776 to 73% in present times. The late nineteenth century saw an increase in the awareness of a need for water quality planning. By the 1930's, typhoid fever and other waterborne diseases were under control. This was achieved by chemical disinfection of domestic water supplies, and did not include treatment of industrial, municipal, or agricultural wastes. The first basic attempt at control was through disposal; not until the 1960's was attention turned to the protection of water resources. Disposal was primarily a matter of placing untreated wastes out of sight by employing surface runoff, filtration and removal by groundwater, or the use of cesspools or privy vaults. Where this was not practical, transmission to the nearest stream was employed. The combined sewer and toilets produced the first alternatives to these methods. Water treatments developed over the years included: filtration, in 1871, and chlorine disinfection, in 1911. Advanced waste water treatment development was hindered because of the easy and economical protection of domestic water supplies by using chlorine. Presently, most municipal waste water is treated. Industrial waste water treatment is being pushed under the impetus of legislation such as PL 92-500. Future treatment problems will deal with the disposal and reuse of treated effluents and by-products. (Collins-FIRL)
W77-07938

WATER AND WASTE WATER ENGINEERING FOR LOW INCOME COMMUNITIES IN DEVELOPING COUNTRIES,

K. Ives.
Proceedings of the Institution of Civil Engineers, Part 1, Vol 62, p 163-165, February, 1977.

Descriptors: *Water supply, *Rural areas, *Water quality control, Impaired water quality, Water reuse, Sanitation engineering, Environmental sanitation, Economics, Social adjustment, Social change, Social values, *Waste water treatment, Water distribution (Applied).
Identifiers: Developing nations.

More than one billion people, or 86% of the rural population in developing countries, lack adequate water supplies. The 'quantity-quality' problem is aggravated by low income and the lack of technical skills in rural areas. Arguments in favor of providing inferior water suggests that inadequate maintenance would cause a breakdown of any treatment system and that adequate untreated polluted water would be less hazardous than inadequate quantities of water. Opposing theories suggest that a piped supply would increase users of a single source, creating epidemic transmission; that water-borne health risks would increase if a piped supply of greater quantity were inferior to an existing smaller supply of better quality; and that an engineer might be legally liable if health damages resulted from his design and installation of a low quality water supply system. It was concluded, in this instance, that any improvement in water was preferable to none at all. It was also suggested that distribution, not treatment, was the major cost in water supply systems. Major considerations in developing countries were discussed in terms of economic, institutional, and technical difficulties. The problem of rural residents moving

to growing towns and cities and continuing their previous sanitation habits was discussed. It was also indicated that wind, animal, or human powered systems might help to eliminate the problems incurred with the use of more technical power systems. Disposal was also considered a problem; the reuse of nightsoil and sewage effluents was suggested. (Collins-FIRL)
W77-07939

REDUCTION IN SEWAGE CONTAMINATION IN SYDNEY ROCK OYSTERS,
New South Wales Univ., Kensington (Australia). School of Food Technology.

R. B. Qadri, K. A. Buckle, and R. A. Edwards.
Food Technology in Australia, Vol. 28, No. 11, p 411, 413-416, November, 1976. 4 tab, 7 ref.

Descriptors: *Oysters, *Pollution abatement, Water pollution, *Sewage effluents, Bacteria, Water quality, Temperature, Salinity, E. coli, Costs, Economics, *Australia.
Identifiers: *Depuration(Oysters), Georges River(Australia), Botany Bay(Australia).

Results were presented of a depuration study involving oysters in the Georges River and Botany Bay area of Sydney, Australia. The depuration process investigated involves the immersion of oysters in tanks of water to allow natural elimination processes of the oysters to occur. Oyster gills act as filters of particulate matter; ingested sewage and fecal microorganisms are trapped in the gill mucus and transferred to the alimentary tract. Shellfish growing in sewage polluted waters digest, retain, and discharge microorganisms. In unpolluted waters, they should reduce the gut flora of sewage bacteria due to the change in the microbial status of the water. Depuration depends on economic factors such as the implied double handling operation for growers, the cost of tanks which would be very large, installation and operation costs, and costs of land to locate the tanks and auxiliary facilities. Results indicated that a significant fecal coliform MPN reduction occurred after one week and that this period is sufficient to clean polluted oysters if water quality, temperature, water salinity, and the season are conducive to active feeding of oysters. Oysters can be purified of heavy E. coli contamination in a short time if they are placed in unpolluted waters. Excessive pollution may require additional time for purification. The area used for depuration should not be subject to sewage or industrial pollution from weather or seasonal effects. It was noted that each species reacts a little differently to depuration processes. Freezing at -23.3 C in an air blast or at -12.2 C in still air produces significant reductions of coliforms. Both depuration in uncontaminated water and freezing and frozen storage can be used to reduce bacterial contamination of Sydney rock oysters. (Collins-FIRL)
W77-07946

TREATING URBAN DRAINAGE AS A UTILITY,
Kramer, Chin and Mayo, Inc., Seattle, Wash.
R. E. Warren.
Public Works, Vol. 108, No. 3, p 85, March, 1977.

Descriptors: *Water management (Applied), *Drainage systems, *Urban runoff, *Urban drainage, Water quality control, Construction, Government, Monitoring, Inspection, Cleaning, Storm sewers, Streams.

Water supply, domestic and industrial waste treatment, and solid waste management have attained highly effective levels. The treatment and control of urban drainage and runoff have not been so effectively handled. It was suggested that drainage be considered like a utility, and handled in the same manner as waste water treatment and quality control. Suggestions included the establishment of a separate department which would be responsible for drainage and runoff water quality. Among its responsibilities would be street sweeping/cleaning,

catch basin and storm sewer cleaning, and open stream preservation. It would also play a part in solid waste disposal and other departments to assure that these wastes would not enter drainage systems because of poor storage practices. It would handle the issuing of permits relative to development; the enforcement of rules and regulations on construction; runoff control; water quality and related issues; and inspection and monitoring. The final consideration in establishing this kind of department would be financing, which could be provided by assessing service charges. (Collins-FIRL)
W77-07947

THE USE OF SEWAGE EFFLUENT AS POWER STATION COOLING WATER.

Central Electricity Generating Board, Leatherhead (England). Croydon Power Station. T. H. Humphris. Water Research, Vol. 11, No. 2, p 217-223, 1977. 4 fig, 1 tab, 1 ref, 1 append.

Descriptors: *Condensers, *Cooling water, *Sewage effluents, Water reuse, Powerplants, Cleaning, Sludge, Heat transfer, Calcium, Phosphate, Nitrification, Bacteria, Ammonia, Performance, Oxidation. Identifiers: Croydon Power Station (England).

Various aspects of the use of sewage effluent as cooling water in power stations were discussed. The Croydon Power Station has used sewage effluents for this purpose for twenty years. One problem encountered was that condenser tubes were fouled with calcium phosphate along with smaller amounts of calcium carbonate, silica, and organic matter. This produces a heat transfer loss and reduces station efficiency. Manual cleaning reduced soft sludge, and acid washing was used to remove carbonate scale. Calcium phosphate was the major source of fouling and could be controlled by limiting the concentration of calcium and/or total phosphate ions in solution, or by lowering the pH of circulating water to decrease available HP_4 ions by conversion to H_2P_4 . At power stations other than Croydon, oxidation of ammonia salts occurred in the cooling water, probably through the action of nitrifying bacteria. The production of acid waters following ammonia oxidation was also noticed. The introduction of nitrification at Croydon could provide a means of conditioning circulating water at reduced cost. Control processes have exchanged the former sludge problem for one caused by an organic film contamination. The use of hypochlorite solution overnight did not produce consistent good results. Cleaning is now accomplished by draining the water side of the condenser and opening access doors, running hot condensate from the feed system to the steam side, and drying overnight. Flaked deposit then washes out as the water circulation is restored. (Collins-FIRL)
W77-07949

WATERSHED MANAGEMENT AND WATER QUALITY.

Environmental Protection Agency, Boston, Mass. Water Supply Branch. P. C. Karalekas, Jr. Journal of the New England Water Works Association, Vol. 91, No. 1, p 1-11, March, 1977. 9 ref.

Descriptors: *Watershed management, *Water quality control, *Water supply, *Water yield improvement, Water utilization, Surface runoff, Pollutants, *Pollution abatement, Water pollution sources, Environmental control.

The relationship of watershed management to water quality was evaluated. Two objectives of watershed management for municipal water supplies are: to maintain or enhance water quality through the control or elimination of contamination sources, and to maintain or improve total

water yields from watersheds. The former receives the greater attention. Physical contaminants, chemical contaminants, and microbiological contaminants are the major pollutants. There should be adequate control of turbidity, color, temperature, settleable solids, taste, and odor. Measures should be taken against municipal and industrial wastes discharges, and other chemical contaminant sources such as agricultural runoff and roadway runoff. Diversion of storm runoff can be helpful in these instances. Recreational uses of watersheds could be prohibited or limited to prevent contamination from all classes of pollutants. Primarily, frequent analysis and inspections and a knowledge of contamination sources are needed to ensure watershed water quality. (Collins-FIRL)
W77-07951

MAKING AQUATIC WEEDS USEFUL: SOME PERSPECTIVES FOR DEVELOPING COUNTRIES.

National Academy of Sciences, Washington, D.C. Commission on International Relations. For primary bibliographic entry see Field 4A.
W77-07964

WHOLE-LAKE EUTROPHICATION EXPERIMENTS WITH PHOSPHORUS, NITROGEN AND CARBON.

For primary bibliographic entry see Field 5C.
W77-07965

EXPERIMENTAL STUDY OF THE ACTION OF PESTICIDES ON THE MICROFLORA OF BODIES OF WATER, (IN RUSSIAN), Nauchno-Issledovatel'skii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR). For primary bibliographic entry see Field 5B. W77-07982

ENVIRONMENTAL POLICY CHOICE UNDER UNCERTAINTY.

Harvard Univ., Cambridge, Mass. Public Policy Program. For primary bibliographic entry see Field 6G.
W77-08004

THE CURRENT STATE OF ENVIRONMENTAL POLICY.

Senate, Washington, D.C. For primary bibliographic entry see Field 6G.
W77-08005

A NOTE ON THE FAIR DIVISION OF POLLUTION RIGHTS.

Siena Univ. (Italy). For primary bibliographic entry see Field 6G.
W77-08006

RECREATIONAL USE OF SMALL STREAMS IN WISCONSIN.

Wisconsin Dept. of Natural Resources, Madison. R. A. Kalnicky. Technical Bulletin No 95, 1976. 19 p. 19 fig, 12 tab, 6 ref.

Descriptors: *Streams, *Recreation demand, *Water pollution control, Water pollution, Recreation facilities, *Wisconsin, Surveys, Benefits, Pollution abatement, *Water quality standards, Water quality, Use rates, Stream improvement, Stream-flow.

The significance of small streams as a recreational resource and the potential recreational benefits to be derived from improving the water quality of these watercourses was surveyed, in order to determine appropriate water quality standards and to set pollution abatement priorities. It was found that small streams averaged 800 hours of recrea-

tional uses per stream mile per year. The differences in recreational use between discharge-affected streams and nonaffected streams were statistically significant. Only one-fourth to one-half as much recreational use was found on discharge-affected streams as on nonaffected streams. Recreational facilities also occurred in greater numbers along nonaffected streams. The type of property along the watercourse affected the use rate, with residential households making much greater use than agricultural households. Hydrologic characteristics of streams were also shown to be related to their frequency of recreational use. Small streams which experienced continuous flow and supported fish and aquatic life had much greater recreational use. Survey results suggest that recreational use on continuous streams and streams classified as supporting fish and aquatic life would improve significantly if the water quality were improved. However, recreational use on intermittent streams and those not supporting fish or aquatic life would probably not measurably increase if the water quality were improved. (Luedtke-Wisconsin)
W77-08008

METHOD OF FILTERING OIL FROM LIQUIDS.

Hydromation Filter Co., Livonia, Mich. (Assignee). G. Hirs. U.S. Patent No 3,992,291, 5 p, 10 ref; Official Gazette of the United States Patent Office, Vol 952, no 3, p 1209, November 16, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Filtration, Coagulation, Oil pollution, Oily water, *Oil wastes. Identifiers: *Black walnut shells, Filter beds, Backwashing.

A method for filtering suspended oil contaminants from an aqueous-based liquid includes flowing the contaminated liquid through a bed of granulated black walnut shells which have a relatively weak affinity for oil. The suspended oil is coalesced during flow through the filter bed to form globular oil particles that are large enough to become entrapped in the interstices of the filter bed. After a substantial quantity of oil has been accumulated in the filter bed, the bed is rejuvenated by flowing backwash liquid through to provide a high velocity scrubbing to free at least a portion of the accumulated oil from the bed, the shells' weak affinity for oil facilitating such rejuvenation. Next, the bed is reformed and a subsequent filtration cycle is initiated. (Sinha-OEIS)
W77-08011

MOVING BELT-TYPE OIL SKIMMER WITH PROPULSION INDUCED FLOW, METHOD AND APPARATUS.

Marine Construction and Design Co., Seattle, Wash. (Assignee). E. L. Grimes, and D. W. Lerch. U.S. Patent No 3,992,292, 6 p, 5 fig, 8 ref; Official Gazette of the United States Patent Office, Vol 952, no 3, p 1207, November 16, 1976.

Descriptors: *Patents, *Water pollution treatment, *Water pollution control, Water quality control, *Oil pollution, Oil spills, *Separation techniques, *Skimming, Equipment. Identifiers: Endless belt.

An oil spill recovery method and apparatus utilizes a low-resistance flow-through endless belt of reticular oleophilic, hydrophobic material and forced flow of water with oil through the belt through induction effected by propulsion means operating at a position immediately behind and beneath the submerged active portion of the belt. In order for a low-resistance flow-through filter belt to operate most effectively at maximum recovery rate, water bearing oil must not only

Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

have free access to the belt but must readily pass through the belt's thickness in preference to flowing around the belt. During such passage of the water, entrained oil is attracted to and held by the myriad of belt fibers which it contacts in the process of passage. A flow enhancement means associated with the filter belt in such a manner that it does not agitate the water nor disperse or emulsify the oil, nor otherwise interfere with the filtration or separation function is devised. The oil skimmer vessel is more effective at widely varying operating speeds than heretofore. (Sinha-OEIS) W77-08012

THE PROBLEM OF THE SANITARY PROTECTION OF THE WATERS OF PORTS AND COASTAL ZONES OF THE BLACK SEA BASIN, (IN RUSSIAN), Black Sea-Azov Watershed Basin Sanitary Epidemiology Station, Odessa (USSR). A. M. Voitenko, N. V. Pavlov, and P. N. Maloman. Gig Sanit 6, p 99-100, 1976.

Descriptors: *Water pollution control, *Harbors, Sewage disposal, Bacteria, Nitrogen compounds, Coasts, *Sewage, Waste disposal. Identifiers: Ukrainian-SSR, *Black Sea, Odessa (USSR).

The sanitary condition of port waters of the Black Sea basin was studied from 1963-1974. Data are presented on Odessa (Ukrainian SSR, USSR), the most characteristic port. On the basis of laboratory studies and sanitary improvement measures, 3 major periods within the period of study are evident: before 1963, 1963-1970, and since 1970. Efforts at more stringent control of the sewage of ships, port facilities, and the city reduced water oxidizability to 3-4 mg/l, increased transparency to 20 cm, maintained a biological O₂ consumption level of 2-3 mg/l, improved the bacterial composition of the water and reduced N-containing substances to trace levels.—Copyright 1977, Biological Abstracts, Inc. W77-08014

OIL SEPARATOR DEVICE.

E. J. Baughcom, and D. C. Lee, Sr. U.S. Patent No. 3,992,297, 12 p, 4 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 952, No 3, p 1211, November 16, 1976.

Descriptors: *Patents, *Oil pollution, *Water pollution control, Water quality control, *Separation techniques, Flow separation, Water pollution sources, Coalescence, Pollution abatement. Identifiers: Bilge water.

A bilge oil separating system or apparatus includes a float controlled bilge pump for pumping the oil contaminated bilge water from the ship's bilge into a splatter chamber. The rather rapid downward flow of the mixed liquids out of the delivery tube changes to a hollow cylindrical downward flow against the inner cylindrical surface of the wall of a splatter chamber. The oil, after the globules are thus coalesced, moves with the water down into a diffuser and then into an upward extending channel provided internally with downward projecting baffles to collect the oil in pockets at the ceiling of the channel to effect gravitational separation of the two liquids and to dampen out any sloshing about of the two-phase liquid. The channel delivers the liquid to the top of an oil-bath water cleaner from which the oil overflows and the cleaned water passes successively through a number of superposed slanting reverse flow chambers from which, through weep holes at the upper part of each chamber, the oil that may have gotten as far as this, flows up into the overflow to be thus recovered, and the clean water is pumped overboard. (Sinha-OEIS) W77-08015

STUDY OF FREE LIVING AMOEBAE IN THE WATERS OF STRASBOURG: PRELIMINARY REPORT, (IN FRENCH), Strasbourg Univ. (France). Inst. of Parasitology. For primary bibliographic entry see Field 5A. W77-08016

COMPOSITION AND METHOD OF INHIBITING GROWTH OF SLIME IN WATER, Betz Lab., Inc., Trevose, Pa. (Assignee). P. Swered, and D. B. Ellis. U.S. Patent No. 3,994,772, 5 p, 2 tab, 4 ref; Official Gazette of the United States Patent Office, Vol 952, no 5, p 2151, November 30, 1976.

Descriptors: *Patents, *Water treatment, *Water quality control, Industrial water, Cooling water, *Slime, Microorganisms, Pulp and paper industry. Identifiers: *Synergistic activity.

This invention relates to certain processes and compositions useful for inhibiting the growth of slime in water and, in particular, water used for industrial purposes; for example, in the manufacture of paper and pulp paper, in cooling water systems and in effluent water treatment. The novel processes and compositions of the invention are processes or mixtures which show unexpected synergistic activity against microorganisms, including bacteria, fungi and algae, which produce, in aqueous systems or bodies, slime which is objectionable from either an operational or aesthetic point of view. Specifically, the invention is directed to the use of compositions comprising alpha-Bromo-p-methylacetophenone and 1,3-dichloroacetone oxime acetate. (Sinha-OEIS) W77-08027

HYGIENIC CRITERIA OF THE COMPLEX ACTION OF CHEMICAL ENVIRONMENTAL POLLUTANTS, (IN RUSSIAN), Moskovskii Gosudarstvennyi Meditsinskii Institut (I) (USSR). Dept. of Public Hygiene. G. I. Sidorenko, and M. A. Pinigin. Gig Sanit 6, p 77-80, 1976.

Descriptors: *Pollutants, *Chemical wastes, *Water quality standards, Public health, Environment, Lethal limits, Water pollution.

On the basis of values for the concentration of a given chemical in a given medium and the maximum permissible concentration of that chemical in that medium, a formula for calculating the maximum permissible load of chemical pollutants in the environment is presented. The maximum permissible load value reflects the combined (>1 chemical) and the complex (>1 medium) action of chemical pollutants.—Copyright 1977, Biological Abstracts, Inc. W77-08029

THE VALUATION OF AESTHETIC PREFERENCES, Wyoming Univ., Laramie. Dept. of Economics. For primary bibliographic entry see Field 6G. W77-08041

ADJUSTMENT COSTS AND OPTIMAL WASTE TREATMENT, State Univ. of New York at Albany. Dept. of Economics. J. D. Harford. Journal of Environmental Economics and Management, Vol. 3, No. 3, p 215-225, October 1976. 1 fig, 7 ref.

Descriptors: *Economic efficiency, *Waste water treatment, *Optimization, *Water quality, *Air pollution, *Environmental control, *Standards, Effluents, Water pollution control, Costs, Taxes, Damages, Benefits, Equations, Mathematical models, Systems analysis. Identifiers: *Cost minimization, Adjustment costs, Time path, Emissions.

Considered are various reasons for changing standards on emissions, effluents, and ambient air and water quality. These reasons include: (1) a secular upward trend in the amount of wastes being created and diffused in the absence of any preventive or treatment measures; (2) costless improvements over time in the technology of waste treatment/prevention; and (3) the rate of change of standards affects the level of costs. It is proposed that adjustment costs may be of significant practical importance in determining the optimal path of waste treatment (at least currently). The problem of minimizing the present value of the sum of treatment plus damage plus adjustment costs is placed in a calculus of variations framework and the optimal time path of waste treatment is characterized as well as the corresponding optimal tax. An example is used to illustrate features of the solution. It is concluded that the future proposed levels of standards may not be reactions to estimated future increases in waste loads or costless improvements in the technology of waste treatment, but simply a recognition that a more rapid approach to desired levels of waste treatment would entail excessive costs of adjustment. (Bell-Cornell) W77-08045

SKIMMER APPARATUS FOR SEWAGE SETTLING TANKS AND THE LIKE, Sybron Corp., Rochester, N.Y. (Assignee). R. F. McGivern. United States Patent 4,011,164. Issued March 8, 1977. Official Gazette of the United States Patent Office, Vol 956, No 2, p 569, March, 1977. 1 fig.

Descriptors: *Patents, *Sedimentation, *Settling basins, Equipment, Water purification, Waste water treatment, Treatment facilities, Municipal wastes, Pollutants, *Skimming. Identifiers: *Skimmers.

A patent was issued for a skimmer apparatus for sewage settling tanks. The device consists of a ramp with one end below the tank liquid level and the other above this level. It is mobilized to move back and forth across the tank. A boom is attached which moves the scum towards and into a scum trough at one end of the tank. (Collins-FIRL) W77-08088

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

OPERATING POLICY ADAPTATIONS FOR A RESERVOIR SYSTEMS, (PHASE I), Purdue Univ., Lafayette, Ind. School of Civil Engineering. For primary bibliographic entry see Field 4A. W77-07603

OPERATING POLICY SIMULATION OR A RESERVOIR SYSTEMS, (PHASE II), Purdue Univ., Lafayette, Ind. School of Civil Engineering. For primary bibliographic entry see Field 4A. W77-07604

SOME ARITHMETICAL RELATIONS OF A MATRIX FOR A CALCULUS OF RESERVOIRS, (QUELQUES RELATIONS ARITHMETIQUES DE MATRICE DANS LE CALCUL DES RESERVOIRS), Direction des Eaux, Baja (Hungary). For primary bibliographic entry see Field 4A. W77-07682

MULTIPLE MARKOV PROCESSES IN HYDROLOGY AND THEIR IMPORTANCE FOR

STOCHASTIC ANALYSIS OF WATER ACCUMULATION PROBLEMS.
Technical Univ. of Prague (Czechoslovakia).
For primary bibliographic entry see Field 4A.
W77-07684

MODEL OF A LAKE RESERVOIR.
Wasserwirtschaftsdirektion, Halle, (East Germany).
For primary bibliographic entry see Field 4A.
W77-07687

SOME PROBLEMS OF STOCHASTIC STORAGE WITH CORRELATED INFLOW.
Technical Univ. of Warsaw (Poland). Inst. of Environmental Engineering.
For primary bibliographic entry see Field 4A.
W77-07689

PENN STATE URBAN RUNOFF MODEL—USER'S MANUAL.
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W77-07797

A DECISION SUPPORT SYSTEM FOR AREA-WIDE QUALITY PLANNING.
Krannert Graduate School of Management, Lafayette, Ind.
C. W. Holsapple, and A. B. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 345.
Price codes: A02 in paper copy, A01 in microfiche.
Socio-Economic Planning Science, Vol 10, p 265-273, 1976. 4 fig, 13 ref. Reprint No. 643-Jan 1977.
OWRT-B-080-IND(2).

Descriptors: *Decision making, *Data storage and retrieval, Data processing, Data collection, *Planning, *Water quality.
Identifiers: *Data management systems, *Area-wide water quality planning, *Generalized planning system.

Factors involved in the development of a decision support system for area-wide water quality planning are discussed. In particular, the Generalized Planning System has been presented as a framework for such a system. Given data and a special group of models for analyzing the data, these can be integrated into the GPLAN framework in order to provide timely, reliable and complete information; at the same time there is recognized the need for a natural easy-to-use planner/system interface and the need for system flexibility that allows adaptation to changing conditions. The interface is provided by the GPLAN query system which allows the execution of large application models, as well as retrieval of any configuration of data (subject to any condition), in response to simple English-like queries. System flexibility is enhanced both by the extended-DML commands which enable dynamic restructuring of the data base schema and by the generalized load program which loads data values from any sequential file into a pertinent network data base.
W77-07810

EXTENSIONS AND CORRECTIONS FOR THE CODASYL APPROACH TO DATA BASE MANAGEMENT.
Krannert Graduate School of Management, Lafayette, Ind.
R. H. Bonczek, C. W. Holsapple, and A. B. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 344.
Price codes: A02 in paper copy, A01 in microfiche.
Information Systems, Vol 2, p 71-77, 1976. 5 fig, 11 ref. Reprint No. 640 - Jan 1977. OWRT-B-080-IND(3).

Descriptors: *Decision making, Data storage and retrieval, Data processing, Data collection, *Planning, *Water quality.
Identifiers: *Data management systems, *Generalized planning system, *CODASYL approach.

In view of the potential contribution of data base management systems as an aid to planning activities, there are certain criteria which such systems must satisfy if the potential is to be realized. Several extensions and improvements for the CODASYL approach to data base management are suggested. Special attention is devoted to the ease and efficacy of data retrieval and application execution, and to the facility and flexibility allowed with regard to data base creation and maintenance.
W77-07811

IMPLEMENTATION OF A DECISION SUPPORT FOR REGIONAL WATER QUALITY PLANNING.
Krannert Graduate School of Management, Lafayette, Ind.
R. Bonczek, C. W. Holsapple, and A. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 342.
Price codes: A03 in paper copy, A01 in microfiche.
Institute for Research in the Behavioral, Economic, and Management Sciences Paper No. 570, October 1976, 30 p, 10 fig, 7 ref. OWRT-B-080-IND(4).

Descriptors: *Decision making, Data storage and retrieval, Mathematical models, Data processing, Data collection, *Planning, *Water quality, *Regional analysis.
Identifiers: *Data management systems, *Regional water quality planning, *Generalized planning systems.

The Generalized Planning System is presented as a framework for the implementation of decision support systems concerned with any of a broad variety of decision applications. The particular application treated here relates to regional water quality planning. The principal considerations are a data base facility that accommodates information in a semantic network, a technique for model formulation, and the automatic interfacing of data with models by means of an English-like, non-procedural mapping language.
W77-07812

INFORMATION TRANSFERRAL WITHIN A DISTRIBUTED DATA BASE VIA A GENERALIZED MAPPING LANGUAGE.
Krannert Graduate School of Management, Lafayette, Ind.
R. H. Bonczek, C. W. Holsapple, and A. B. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 343.
Price codes: A03 in paper copy, A01 in microfiche.
Supplemental: Institute for Research in the Behavioral, Economic and Management Sciences, Paper No. 577, November 1, 1976. 20 p, 6 fig, 13 ref. OWRT-B-080-IND(5).

Descriptors: *Information exchange, Data storage and retrieval, Data processing, Data collection, Planning, Water quality, Programming languages.
Identifiers: *Information transferral, *Data management, *Distributed data base, *Generalized mapping language.

An investigation was made of some of the problems encountered in the management of a data base that is logically distributed. The term logical distribution is used to connote a situation wherein users in various locales are responsible for creation and maintenance of their own portions of a data base, but a user in one locale can access data maintained by a user in another locale. An example of this situation is drawn from the realm of

water quality management. A generalized mapping language is proposed as a mechanism for information transferral within a distributed data base, and a general data structure for supporting the mapping function is illustrated. The presented method accommodates a variety of user views, is independent of whether the data base is geographically distributed or centralized, furnishes a straightforward security mechanism and provides a basis for treating the contingency of uninformed or non-programming users.
W77-07813

AIDING DECISION MAKERS WITH A GENERALIZED DATA BASE MANAGEMENT SYSTEM: AN APPLICATION TO INVENTORY MANAGEMENT.
Krannert Graduate School of Management, Lafayette, Ind.
R. H. Bonczek, C. W. Holsapple, and A. B. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 306.
Price codes: A03 in paper copy, A01 in microfiche.
August 1976. 21 p, 7 fig, 12 ref. OWRT-B-080-IND(1).

Descriptors: *Decision makers, Data storage and retrieval, Data collections, Planning, Management, Materials.
Identifiers: *Data management systems, *Generalized planning system.

The attributes are examined of a generalized data base management system with respect to its impact on managerial decision-making. The discussion focuses upon two primary considerations: (1) the organization of data within a data base such that all intricate relationships are represented; and (2) the utilization of a facile method for nonprogramming users to interrogate the data base. Examples drawn from the field of material requirements planning are used to illustrate the concepts and potential of the generalized data base management system.
W77-07814

OBSERVATIONS ON A GENERALIZED INTELLIGENT QUERY PROCESSOR FOR DECISION SUPPORT.
Krannert Graduate School of Industrial Administration, Lafayette, Ind.
R. H. Bonczek, C. W. Holsapple, and A. B. Winston.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 472.
Price codes: A03 in paper copy, A01 in microfiche.
(1976). 42 p, 8 fig. OWRT-B-080-IND(7).

Descriptors: *Decision making, *Data storage and retrieval, *Data processing, Model studies, Computer programs.
Identifiers: *Data management systems, *Query processor.

A generalized intelligent query processor for decision support is examined. This processor is invariant to changes in the decision making context within which it operates. It utilizes, both empirical and conceptual information which are retained in a single mechanism in order to understand the implications of a query, to formulate a model for the query's solution, and to execute this model with the pertinent data. The user's non-procedural, English-like query may be viewed as the specification of a program to be executed; the query processor may be viewed as a high-level compiler which automatically generates code in a procedural, programming language.
W77-07849

MATHEMATICAL PROGRAMMING WITHIN THE CONTEXT OF A GENERALIZED DATA BASE MANAGEMENT SYSTEM.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.

Field 6—WATER RESOURCES PLANNING

Group 6A—Techniques Of Planning

R. H. Bonczek, C. W. Holsapple, and A. B. Whinston.

Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 454. Price codes: A03 in paper copy, A01 in microfiche. Institute for Research in the Behavioral, Economic and Management Sciences. Paper No. 578, November 1976, 30 p, 12 fig, 12 ref. OWRT B-080-IND(6).

Descriptors: *Data storage and retrieval, *Mathematical models, Data processing, Data collections, Planning, Water quality, *Programming languages, Computer programs, *Computer models, *Algorithms.
Identifiers: *Data management systems, *Generalized planning system, Mathematical programming, Statistical programs, Simulation programs, Query language.

Aspects of mathematical programming are examined within the context of a generalized data base management and query system. This system is general in the sense of its ability to support applications other than mathematical programming and its independence from the actual types of data values available. It is shown how data for mathematical programming may be organized into a network data structure which may be interrogated via non-procedural, English-like queries. Three methods are presented for interfacing math programming algorithms with this data base. Enhanced data manipulation facilities, particular to matrices and systems of equations, are also introduced. Finally a method is shown whereby programs may be integrated into a data structure, enhancing a user's ability to build alternative models for data analysis.

W77-07850

ENVIRONMENTAL POLICY CHOICE UNDER UNCERTAINTY,
Harvard Univ., Cambridge, Mass. Public Policy Program.

For primary bibliographic entry see Field 6G.
W77-08004

MATHEMATICAL MODELING OF REGIONAL WATER-SUPPLY SYSTEMS IN YUGOSLAVIA,
Energoprojekt, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 4A.
W77-08033

ENVIRONMENTAL ASSESSMENT: THE ECOLOGICAL DIMENSION,
Ecoplans Ltd., Waterloo (Ontario).
For primary bibliographic entry see Field 6G.
W77-08034

USE OF STATE ESTIMATION TECHNIQUES IN WATER RESOURCE SYSTEM MODELING, BY DENNIS P. LETTENMAIER AND STEPHEN J. BURGESS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5B.
W77-08035

SIMPLIFIED OPTIMIZATION OF ACTIVATED SLUDGE PROCESS,
Purdue Univ., Lafayette, Indiana. School of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-08036

BEST PRACTICABLE WASTE TREATMENT SCREENING MODEL,
Cornell Univ., Ithaca, N. Y. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W77-08037

OPTIMAL ENGINEERING DESIGN UNDER UNCERTAINTY BY GEOMETRIC PROGRAMMING,
Unternehmensberatung Schumann G.m.b.H., Cologne (West Germany).

For primary bibliographic entry see Field 8C.
W77-08040

A GOAL INTERVAL PROGRAMMING MODEL FOR RESOURCE ALLOCATION IN A MARINE ENVIRONMENTAL PROTECTION PROGRAM,
Texas Univ. at Austin. Center for Cybernetic Studies.

For primary bibliographic entry see Field 6G.
W77-08042

ADJUSTMENT COSTS AND OPTIMAL WASTE TREATMENT,
State Univ. of New York at Albany. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W77-08045

OBJECTIVE FUNCTION AND CONSTRAINTS IN WATER RESOURCES SYSTEMS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
C. C. Kisiel.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 3. IAHS/Unesco, Paris, France, 1974, p 1283-1299 (Session XV). 3 fig, 18 ref.

Descriptors: *Water resources, *Constraints, *Decision making, *Economics, *Water policy, Social aspects, Water demand, Pricing, Groundwater resources, Simulation analysis, Aquifers, Subsurface investigations, Mathematical models, Systems analysis.
Identifiers: *Objective functions, Water restriction indices, Water deficiency, Collective utility, Negentropy.

The examination of constraints and objective functions is at the heart of collective efforts to evolve a science of decision making about water resource systems or any other system. This paper reviews and discusses a group of four articles, found in Volume 2 of the Symposium, which falls within the topic of objective function and constraints in water resources systems. To place in overall perspective this set of papers assigned to this topic, a critical survey of the subject is presented. In a lengthy introduction, system modelling and objective functions are examined and objective functions in a philosophic framework are discussed. Next, the relationship of the four papers to the survey is considered. The papers reviewed are concerned with: indices of water restriction and water deficiency tolerance; water resources and negentropy; large-scale simulation of groundwater flow systems; and water pricing policy. The review is followed by various discussions by participants. (See also W77-06708) (Bell-Cornell)
W77-08046

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS-I,
Illinois Univ. at Urbana-Champaign. Hydrosystems Lab.
For primary bibliographic entry see Field 4A.
W77-08047

OPTIMAL OPERATION OF WATER RESOURCES SYSTEMS-II,
Water Research Association, Marlow (England).
For primary bibliographic entry see Field 4A.
W77-08048

PLANNING OF SYSTEMS FOR REGIONAL DEVELOPMENT IN WATER RESOURCES,
Technion-Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
N. Buras.

In: Mathematical Models in Hydrology, Proceedings of the Warsaw Symposium, Poland, July 1971, Volume 3. IAHS/Unesco, Paris, France, 1974, p 1334-1346 (Session XVIII). 1 fig, 4 ref.

Descriptors: *Water resources development, *Regional development, *Planning, *Optimization, *Simulation analysis, Hydrology, Evaluation, Runoff, Hydraulics, River systems, Reservoir operation, Flow, Aqueducts, Linear programming, Dynamic programming, Computer models, Equations, Systems analysis, Mathematical models.
Identifiers: Benefit maximization, Power deficit minimization, Hydro power, Spain, Sector model.

Considered are nine papers falling within the topic of the planning os systems for regional development in water resources, published in volume 2 of the Symposium. Seven of these papers are summarized in some detail. The articles refer to a broad range of problems: (1) a model designed to accomplish hydrologic and economic evaluations for any type of river basin; (2) simulation of the Llobregat River system in Spain to derive an operating policy which satisfies a set of given monthly demands for water, including economic aspects; (3) optimal water distribution in river development systems, using dynamic programming to derive the maximum benefits; (4) linear programming to minimize power deficit and optimize flow planning in multi-reservoir hydro-power systems; (5) hybrid computer analysis, based on Darcy's law, of a combined surface water-groundwater system; (6) initial conceptual planning framework for the conjunctive use of the Tajo-Segura Aqueduct surface system and aquifers of the La Mancha area in Spain; and (7) the use of a sector model for regional and national water resources planning in East Pakistan. Following the article are discussions by several of those authors whose papers were reviewed herein and by two other authors participating in the Symposium. (Bell-Cornell)
W77-08049

MODELING MULTIPLE-USE IN NATURAL AREAS: PART II - THE SANTEE SWAMP STUDY,
Ryckman, Edgerley, Tomlinson and Associates, Inc., St. Louis, Mo.
D. W. York, B. C. Dysart, III, and L. W. Gahan.
Water Resources Bulletin, Vol. 13, No. 2, p 238-297, April 1977. 2 fig, 5 tab, 17 ref.

Descriptors: *Water resources development, *Planning, *Assessment, *Cost-benefit analysis, Environment, Economics, Optimization, *Swamps, *South Carolina, Management, Demand, Benefits, Computer programs, Algorithms, Mathematical models, Operations research.
Identifiers: *Multiple-use, Natural areas, *Santee Swamp(S. Carolina), Timber harvest, Penalty costs, Sensitivity analysis, Benefit maximization.

The previous paper in this two-part series (See W77-07530) presented the basic information concerning a newly developed mathematical model of multiple-use in natural areas. The model is a unified system for the assessment of cases where development is proposed for relatively natural areas. This paper presents the results of an application of the model to a study of the proposed timber harvest in the Great Santee Swamp in South Carolina. This was done in an effort to demonstrate the utility of the model as a planning and assessment tool. Four potential uses of the Swamp were investigated: logging of hardwood saw timber, hunting, fishing, and nature observation. The model system proves to be extremely useful in the evaluation of potential management schemes and in the selection of the most promising

or optimal management plan. The optimal plan is that which derives the greatest net benefits. Results show that the net benefits for the proposed timber harvest do not reflect very large penalty costs which drive net benefits negative. Penalty functions were incorporated into the model to insure the selection of a feasible solution by the optimization algorithm. The model program was run on an IBM System 370/155 computer, and sensitivity analysis was performed to identify critical parameters in the analysis. The model can play a vital role in the decision making process. Inclusion of environment-related costs and benefits, option value, and desirability enable planners to more fully describe amenity values of relatively natural areas. (Bell-Cornell)
W77-08050

6B. Evaluation Process

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER, FOREST PRODUCTS PROJECTIONS AND RECREATION PROJECTIONS, APPENDICES IV AND V, Oregon State Univ., Corvallis. Forest Research Lab.
For primary bibliographic entry see Field 6D.
W77-07625

A LAND USE DECISION METHODOLOGY FOR ENVIRONMENTAL CONTROL, Rocky Mountain Center on Environment, Denver, Colo.
For primary bibliographic entry see Field 6G.
W77-07629

ENVIRONMENTAL GEOLOGIC ASPECTS OF PLANNING, CONSTRUCTING, AND REGULATING RECREATIONAL LAND DEVELOPMENTS, Wisconsin Dept. of Administration, Madison. State Planning Office.
For primary bibliographic entry see Field 6G.
W77-07630

MUNICIPAL INFORMATION SYSTEMS: EVALUATION OF POLICY RELATED RESEARCH. VOLUME 2. COMPUTER UTILIZATION IN LOCAL GOVERNMENT, California Univ., Irvine. Urban Information Systems Research Group.
K. L. Kraemer, H. C. Lucas, R. D. Hackathorn, and R. C. Emrey.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-245 688. Price codes: A10 in paper copy, A01 in microfiche. Prepared for the National Science Foundation, September 1974, 192 p., 94 ref.

Descriptors: Computers, *Data processing, *Information retrieval, *City planning, Equipment, Data storage and retrieval, Research and Development, Design, Cost-benefit ratio, Technology, Government.
Identifiers: *Municipal Information Systems, Computer utilization, Systems design.

This volume is one of 10 volumes evaluating policy-related research on Municipal Information Systems. It discusses what is currently known about computer utilization in municipal and county governments; and provides a comprehensive review and critical evaluation of existing research and recommends goals for future studies. Research is systematically reviewed for validity and policy utility. Policy utility is determined by its contribution to information about national trends, local benchmarks, effectiveness, transferability, costs and benefits, and system design. Studies are divided into categories of stock (supply and utilization of computer resources) and need (demand for information and data processing capability). The rate of adoption, the increasing in-

vestment, and the expanding application areas show that computer utilization is growing. The research reviewed provides a few benchmarks on expenditures, computer hardware, user applications, personnel salaries, and general data needs to guide local officials. Future research should require more rigorous methodology and descriptive models from which testable hypotheses can be derived. Both the quantity and quality of research is very limited. Specific findings should be interpreted with caution pending the results of further research. Current studies have generally failed explicitly to address policy question, although some have touched on them indirectly. (Nessa-NC).
W77-07631

AN ANALYSIS OF ALTERNATIVE FLOOD MANAGEMENT PLANS IN UPSTREAM WATERSHEDS. CONNECTICUT RIVER BASIN SUPPLEMENTAL FLOOD MANAGEMENT STUDY, PHASE 2, Soil Conservation Service, Durham, N.H.
For primary bibliographic entry see Field 6F.
W77-07632

ENVIRONMENT AND REGIONAL PLANNING, A PILOT STUDY OF THE COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY, NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
For primary bibliographic entry see Field 6G.
W77-07633

HIERARCHICAL MODELING FOR THE PLANNING AND MANAGEMENT OF A TOTAL REGIONAL WATER RESOURCE SYSTEM: JOINT CONSIDERATION OF THE SUPPLY AND QUALITY OF GROUND AND SURFACE WATER RESOURCES, Case Western Reserve Univ., Cleveland, Ohio. Dept. of Systems Engineering.
For primary bibliographic entry see Field 4B.
W77-07793

IMPLEMENTATION OF NON-STRUCTURAL ALTERNATIVES IN FLOOD DAMAGE ABATEMENT, Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
For primary bibliographic entry see Field 6F.
W77-07795

CITIZEN ATTITUDES TOWARD MANAGEMENT OF THE CHESAPEAKE BAY, Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics. L. A. Shabman, and P. M. Ashton.
Available from the National Technical Information Service, Springfield VA 22161 as PB-267 308. Price codes: A04 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, VWRRC Bulletin 96, February 1976. 69 p., 21 tab, 16 ref, 4 append. OWRT A-059-VA(2).

Descriptors: *Chesapeake Bay, Environment, Social aspects, Attitudes, Surveys, Environmental effects, Social participation, Water quality, Waste disposal, Management, Water resources development, Planning, Pollution abatement, Social values.
Identifiers: Public involvement, Coastal Zone Management.

A survey of Chesapeake Bay Residents was conducted to determine how a selected group of citizens felt about certain current issues facing the Bay. Compared with the general population, the survey respondents earned higher incomes, were more highly educated, were professionally employed, and seemed heavily involved in public ser-

vice activities. They also tended to display an 'environmentalist' bias. Even so, respondents did not feel informed about the ongoing Corps Engineers study of the Bay or about the Maryland and Virginia Coastal zone management programs, which are the three major planning efforts now being conducted on the bay. Respondents expressed some mild dissatisfaction with current administrative, legal, and management programs, but expressed little desire for passage of new laws or creation of a single management agency for the Bay as a whole. While the respondents felt that the public did have reasonable access to the decision-making process, they indicated a fairly strong concern over what they saw as public apathy toward the problems of the bay. Thirteen specific Bay problems were ranked in importance by the respondents. In both states, waste disposal, bilge dumping, wetlands preservation, offshore oil development, dredge-material disposal, and power-plant siting were identified as issues of major importance. Several problems received substantially less emphasis. These included runoff of pesticides and fertilizers, shoreline erosion, population growth, and improvement of public access to the Bay. General implications drawn from these results include: (1) any organization of citizens probably will tend to represent only limited aspects of public concern, and (2) agencies should expect to deal with a less than representative socio-economic cross section of society in their public-participation programs.
W77-07796

AIDING DECISION MAKERS WITH A GENERALIZED DATA BASE MANAGEMENT SYSTEM: AN APPLICATION TO INVENTORY MANAGEMENT, Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07814

APPRAISAL OF AREA-WIDE WASTE WATER PLANNING, Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 5G.
W77-07874

1776-1976: NOTES ON WATER QUALITY PLANNING, Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 5G.
W77-07938

LOCAL CONTROL OF LAND USE: PROFILE OF A PROBLEM, Wisconsin Univ., Madison. Dept. of Rural Sociology.
For primary bibliographic entry see Field 6F.
W77-08003

METHODOLOGICAL PROBLEMS IN ESTIMATING RECREATIONAL DEMAND FUNCTIONS AND EVALUATING RECREATIONAL BENEFITS, Highbury Technical Coll., Portsmouth (England). Dept. of Business Studies.
A. T. Flegg.
Regional Studies, Vol 10, No 3, p 353-362, 1976. 10 tab, 14 ref.

Descriptors: *Recreation demand, *Methodology, *Evaluation, Benefits, Estimating, Reservoirs, Fishing, Boating, Aesthetics, Elasticity of demand, Analysis, Recreation.
Identifiers: Aggregation, Sensitivity analysis, Clawson method.

Various methodological problems implicit in the conventional Clawson procedure for evaluating recreational benefits are discussed and illustrated using data on fishing, sailing, and visiting a Welsh

Field 6—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

reservoir. It is shown that: (1) the conventional practice of using visits per capita as the dependent variable in demand functions is likely to result in spurious estimates of benefits as well as strongly biased estimates of the elasticity of visits with respect to the explanatory variables; (2) the traditional use of highly aggregated data is neither necessary nor desirable, as aggregation of the fishing data was found to have a negligible effect on estimated values; (3) the standard assumption that travelling time is a cost should be replaced by a zero value as shown by an iterative procedure; (4) the Clawson method is based on the questionable value judgment that households' preferences should be weighted by rates of car ownership and (5) the orthodox practice of not estimating separate demand functions for holders of daily and seasonal permits is unsound. To resolve these methodological problems in a satisfactory manner however, will require better survey data, particularly on respondents' travelling times, incomes, and use of alternative recreational sites. (Luedtke-Wisconsin)
W77-08007

RECREATIONAL USE OF SMALL STREAMS IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5G.
W77-08008

TOLLS: EFFICIENCY AND EQUITY ISSUES FOR INLAND WATERWAYS,
Association of American Railroads, Pittsburgh, Pa.
For primary bibliographic entry see Field 6C.
W77-08039

THE VALUATION OF AESTHETIC PREFERENCES,
Wyoming Univ., Laramie. Dept. of Economics.
For primary bibliographic entry see Field 6G.
W77-08041

OBJECTIVE FUNCTION AND CONSTRAINTS IN WATER RESOURCES SYSTEMS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6A.
W77-08046

MODELING MULTIPLE-USE IN NATURAL AREAS: PART II - THE SANTEE SWAMP STUDY,
Ryckman, Edgerley, Tomlinson and Associates, Inc., St. Louis, Mo.
For primary bibliographic entry see Field 6A.
W77-08050

REMOTE SENSING APPLICATIONS IN WATER RESOURCES MANAGEMENT BY THE CALIFORNIA DEPARTMENT OF WATER RESOURCES,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7B.
W77-08078

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES, VOLUME I, FINANCING PACIFIC NORTHWEST ELECTRIC GENERATION,
Kell, Alterman and Runstein, Portland, Ore.
For primary bibliographic entry see Field 8C.
W77-07601

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES, VOLUME II, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES,
Kell, Alterman and Runstein, Portland, Ore.
For primary bibliographic entry see Field 6E.
W77-07602

ESTIMATING COSTS OF WASTE WATER SLUDGE DISPOSAL,
Boyle Engineering Corp., Orlando, Fla.
For primary bibliographic entry see Field 5E.
W77-07861

FINANCING: THERE MUST BE A BETTER WAY,
Quad-City Solid Wastes Committee, Paterson, N.J.
For primary bibliographic entry see Field 5G.
W77-07873

A NOTE ON THE FAIR DIVISION OF POLLUTION RIGHTS,
Siena Univ. (Italy).
For primary bibliographic entry see Field 6G.
W77-08006

TOLLS: EFFICIENCY AND EQUITY ISSUES FOR INLAND WATERWAYS,
Association of American Railroads, Pittsburgh, Pa.
L. S. Case, and L. B. Lave.
Management Science, Vol. 23, No. 8, p 811-819, April 1977. 4 tab, 9 ref.

Descriptors: *Inland waterways, *Economic feasibility, *Efficiencies, *Equity, *Evaluation, Costs, Benefits, Queueing theory, Transportation, Resource allocation, Taxes, Political aspects, Rivers, Mathematical models, Systems analysis.
Identifiers: *Tolls, *User charges, License fees, Waterway expansion, The Illinois Waterway.

Transportation requires large amounts of capital in fixed facilities such as roads, tracks, or canals. Inland waterway transport is unique among modes, since it neither owns its right-of-way nor pays taxes to support its construction and maintenance. Although user charges are widely employed to recover the costs of publicly provided investments, proper theoretical foundation has not been made for their application to inland waterway transport. In this paper, this foundation is provided, focusing on efficiency of allocation of resources, in equity of taxation, and on administration simplicity of each toll scheme. Section one of the paper presents the criteria to be used in evaluating waterway user charges. Section two appraises possible alternative tolls and estimates the rates that would be needed to recover current expenditures; stochastic distributions are assumed to be Poisson and queueing theory is utilized. A combination of toll schemes (segment tolls, locking fees, and congestion tolls) are argued to be economically and politically feasible and to dominate fuel taxes and license fees. The appendix presents an example of the benefits and costs of waterway expansion and a test of the predictive power of the queueing model. It is shown that the predictions of queueing theory correspond to reality. (Bell-Cornell)
W77-08039

THE DEVELOPMENT OF COSTS RECOVERY SCHEME: SUGGESTED APPROACHES FOR MUNICIPAL OR REGIONAL WASTE WATER TREATMENT PLANTS,
Kansas Univ., Lawrence.
A. A. Thomopoulos.
PhD Thesis, 1976. 137 p.

Descriptors: *Cost repayment, *Cost allocation, Reimbursable costs, Non-reimbursable costs, Capital costs, Operating costs, Maintenance costs, Replacement costs, Interest rates, Annual costs, Treatment facilities, Use rates, Water rates.
Identifiers: Cost recovery.

An approach to costs recovery for financing waste water treatment plants was developed using some guidelines of the 1972 Federal Water Pollution Control Act Amendments. The study was based on an examination of existing cost allocation and user charge methods for waste water treatment. A charge method based on treatment costs provides a readily understandable basis for levying charges without punitive implications. The identification of recoverable costs is difficult with current methods and, in most cases, the costs of future expansion are not considered. The concept of costs recovery from industrial waste dischargers only contradicts the principle of distributing cost amongst all dischargers. The costs to be recovered should appreciably exceed the costs of borrowed money in order to avoid future borrowing. Recoverable costs should include total capital and interest costs, as well as the operation, maintenance, and replacement costs of present facilities. An incremental scheme will allow for a proportional increase in annual recoverable costs as users and waste water flows increase over time. (Collins-FIRL)
W77-08085

6D. Water Demand

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. IRRIGATION AND FOOD PRODUCTS PROJECTIONS, APPENDIX II,
Oregon State Univ., Corvallis. Cooperative Extension Service; and Oregon State Univ., Corvallis. School of Agriculture; and Oregon State Univ., Corvallis. Agricultural Experiment Station.
M. N. Shearer, R. C. Youmans, and K. Rykboost.
Prepared for Oregon Water Resources Board, (Salem), December 31, 1968. 131 p, 112 tab.

Descriptors: *Projections, *Forecasting, *Population, *Water supply, *Water demand, *Irrigation, *Irrigation water, Agriculture, *Food processing industry, *Industrial water, *Industrial water(Use), *Oregon, Crop yield, Water utilization.
Identifiers: Food product projections, North Coast River Basin(OR), Willamette-Sandy Basin(OR), Hood River Basin(OR), Deschutes Basin(OR), John Day Basin(OR), Umatilla Basin(OR), Grande Ronde Basin(OR), Powder Basin(OR), Malheur Basin(OR), Owyhee Basin(OR), Malheur Lakes Basin(OR), Goose and Summer Lakes Basin(OR), Klamath Basin(OR), Rogue Basin(OR), Umpqua Basin(OR), South Coast Basin(OR), Mid Coast Basin(OR).

Projections for the development of irrigation in the 17 river basins in Oregon are presented for the year 2020. These predictions are based on various assumptions, those which tend to encourage development of irrigation and those which substitute or replace the need for irrigation development. It is assumed that national population increase and pressure to realize increases in crop yields will encourage irrigation. The study did not consider relations of specific crops to small river basins or the ability of the area to bid for land and water for their production. It is also speculated that technological advances will enable higher crop yields on land in its present condition without requiring irrigation. Projections are based on the estimate of irrigated farm land in 1964 in the State and include analysis reflecting soil and temperature conditions. Irrigated land is expected to increase two thirds by the year 2020 and 2070 based on restrictive assumptions. Present location of production, the amount of water consumed in a plant, the ability of a firm to reduce its consumption of water given a certain incentive, and the

ability to contract or expand production were determined. Projections were generally limited in reliability. Population projections are used to approximate increased demand for food and related products. (Gentry-NC)
W77-07623

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. SELECTED MAJOR WATER USING INDUSTRIES AND POPULATION PROJECTIONS, APPENDIX III.
CH2M/Hill, Corvallis, Ore.
Prepared for the Oregon State Water Resources Board, (Salem), June 1969. 289 p, 22 fig, 21 tab, 2 append.

Descriptors: *Projections, *Water demand, *Water supply, *Water management(Applied), *Water requirements, *Water users, *Water utilization, Population, Growth rates, *Industrial production, *Industrial(Water), *Industrial wastes, *Oregon, Water consumption, Water pollution.

Identifiers: *Population projections, North Coast Drainage Basin(OR), Willamette and Sandy Drainage Basins(OR), Hood Drainage Basin(OR), Deschutes Drainage Basin(OR), John Day Drainage Basin(OR), Umatilla Drainage Basin(OR), Grande Ronde Drainage Basin(OR), Powder Drainage Basin(OR), Malheur Drainage Basin(OR), Owyhee Drainage Basin(OR), Malheur Lake Drainage Basin(OR), Goose and Summer Lakes Drainage Basin(OR), Klamath Drainage Basin(OR), Rogue Drainage Basin(OR), Umpqua Drainage Basin(OR), South Coast Drainage Basin(OR), Mid-Coast Drainage Basin(OR).

Population and industrial projections for river basins in Oregon with which to anticipate water demand for the years 2020 and 2070 are presented. Two approaches to population projection are used. The first is a modified demographic approach: births, deaths, and immigration are projected on a national basis; on the basis of trends projected by various authorities, the proportion of national population living in the Pacific Northwest, and Oregon specifically, are estimated; populations of regions, river basins, and metropolitan areas are factored from statewide projections; projected river basin population is allocated to urban and rural areas. The second is an economic base approach: economic activity and employment and labor force participation rates are projected; ratios of population to labor force are developed, and on the basis of these factors, population projects are made. Production levels for selected industries that use relatively large quantities of water were projected and water requirements and pollutant loadings were calculated. Factors used in projecting future production of industry include resource availability, growth of national and regional markets, and special factors such as power cost and transportation. Selected industries were lumber and plywood production, petroleum refining, chemicals and petrochemical manufacturing, mining, mineral processing, and primary and rare metals manufacturing. The final section of the report presents detailed population and selected industrial water requirement projections for 18 drainage basins in the State. (Gentry-NC)
W77-07624

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. FOREST PRODUCTS PROJECTIONS AND RECREATION PROJECTIONS, APPENDICES IV AND V.
Oregon State Univ., Corvallis. Forest Research Lab.
R. Snyder, and R. O. McMahon.
Prepared for the Oregon Water Resources Board, (Salem), June 1969. 46 p, 2 fig, 8 tab, 24 ref, 2 append.

Descriptors: *Forecasting, Timber management, Population, Recreation, *Outdoor recreation, *Recreation demand, Recreation facilities, Water

reuse, *Water consumption, *Water requirements, *Water sports, Pulp and paper industry, *Oregon, Economic prediction, Camping, Lakes, Reservoirs, Industrial water, Population.

Identifiers: North Coast River Basin(OR), Willamette & Sandy River(OR), Hood River Basin(OR), Deschutes River Basin(OR), John Day River Basin(OR), Umatilla River Basin(OR), Grande Ronde River Basin(OR), Powder River Basin(OR), Malheur River Basin(OR), Owyhee River Basin(OR), Malheur Lake(OR), Goose and Summer Lakes(OR), Klamath River Basin(OR), Rogue River Basin(OR), Umpqua River Basin(OR), South Coast Basin(OR), Mid Coast Basin(OR).

In Appendix IV, projections of ultimate timber harvests were calculated for each river basin in Oregon based on data supplied by the Pacific Northwest Forest and Range Experiment Station. The U.S. Forest Service method was used to calculate projections which assumed continued production of saw logs to be intensified through the use of intermediate harvests and by consolidation of forest holdings into fewer hands. Increased yields through fertilization, irrigation or genetic improvements were not considered. Projected overall cut will not drastically change, though this stability does not hold for individual basins which are presently overcut or undercut. In the year 2020, 43% of total solid wood harvest will be pulped; for 2070, the corresponding figure is 46%. Water reuse is expected to increase dramatically, from 2.39 in 1966 to 5 in 2020 and to 6 in 2070 (where rate of water use equals water use if no recirculation, minus water intake, divided by water intake). With increased water reuse, the proportion of intake water consumed will increase to 30% in 2070. In Appendix V, estimates for 2020 and 2070 are given for required lake and reservoir surface area and associated evaporation losses, and water requirements for camping and picnicking activities. These projections are based on the assumption that recreation behavior related to socio-economic conditions will parallel national characteristics; that income, mobility, leisure time, etc., will not be limiting factors; and that out-of-state recreation participants will continue to be important. Projections are presented for each of 18 river basins for individual recreation activities and water requirements. (Gentry-NC)
W77-07625

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. WATER QUALITY CONTROL PROJECTIONS, APPENDIX VI.
Oregon State Sanitary Authority, Salem.
For primary bibliographic entry see Field 5G.
W77-07626

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. PROTECTION OF AREAS OF ORIGIN, APPENDIX VII.
Wendell and Schwan, Washington, D.C.
Prepared for the Oregon State Water Resources Board, (Salem), July 15, 1968. 51 p, 1 appendix.

Descriptors: *Water demand, *Water supply, *Water transfer, *Inter-basin transfers, *Water law, *Legal aspects, *Oregon, *Water management(Applied), Imported water, Diversion, Water rights, Colorado River Basin, Pacific Northwest U.S. Interstate compacts.
Identifiers: Northwest State Compact, Federal-Interstate water compact.

Oregon has taken strong legal and administrative measures to protect its water from being diverted to the arid southwestern United States. Protection can take the form of prohibiting exportation of water or allowing water diversion subject to conditions of recapture, delivery of compensating supplies or other compensatory benefits. Current federal legislation, H.R.3300, designed to allow the Colorado River Basin to receive water from the Northwest, illustrates the question of whether

state law and other measures can withstand the political pressure which arid states can wield in Congress to exercise Congressional power to regulate and control surface water use. Therefore proposals include political compromises and institutional innovations. Four courses of possible action are presented: (1) proposing a federal statute giving areas of water origin the protection they deem essential while at the same time asserting federal authority in the water rights field; (2) creation of a Northwest State Compact dealing with in-basin diversion and compensation, and limits on out-of-basin diversion; (3) creation of a compact encompassing water exporting and water importing states; (4) creation of a compact including only northwestern states; (5) creation of a compact including only northwestern states and the federal government. It is suggested that a federal-interstate compact with both importing and exporting states would afford greatest potential protection of areas of water origin. (Gentry-NC)
W77-07627

WATER RESOURCES AND WATER-SUPPLY DEVELOPMENT IN TRINIDAD AND TOBAGO,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
L. Forde.

Journal of the American Water Works Association, Vol 69, No 4, p 188-195, April 1977. 1 fig, 10 tab, 7 ref.

Descriptors: *Water supply, *Water resources, *Water supply development, *Water demand, Industrial water, Rural areas, Sugarcane, Hydrology, Groundwater resources, Surface water availability, Water resources development, Foreign countries, Foreign research.
Identifiers: *Caribbean, *Trinidad, *Tobago.

The current demand for water in Trinidad and Tobago exceeds supply. An inventory of water resources that must be developed in a coherent long-term manner to facilitate projected growth has been compiled. Past history of water development and strategies for future demands were detailed in this article. The proposed Point Lisas development with its requirement of 2.8 cu m/sec (63 mgd) by 1985 will aggravate this situation. The present new projects will increase the water production in 1980 by 2.9 cu m/sec (67 mgd). With the increased domestic demand because of increased population and standard of living, the situation will be much worse than at present. There is considerable uncertainty in the forecast of industrial demand, and most likely any revision in this figure will be downward. (Lee-ISWS)
W77-07785

OPTIMIZATION OF WATER USE FOR IRRIGATION,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-07851

METHODOLOGICAL PROBLEMS IN ESTIMATING RECREATIONAL DEMAND FUNCTIONS AND EVALUATING RECREATIONAL BENEFITS,
Highbury Technical Coll., Portsmouth (England).
Dept. of Business Studies.
For primary bibliographic entry see Field 6B.
W77-08007

RECREATIONAL USE OF SMALL STREAMS IN WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5G.
W77-08008

Field 6—WATER RESOURCES PLANNING

Group 6D—Water Demand

REMOTE SENSING INPUTS TO WATER DEMAND MODELING,
California Univ., Santa Barbara. Geography Remote Sensing Unit.
For primary bibliographic entry see Field 7B.
W77-08080

6E. Water Law and Institutions

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND LICENSING PROCEDURES, VOLUME II, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES,
Kell, Alterman and Runstein, Portland, Oreg.
L. Jourlman, R. M. Jackson, and J. Keller.
Completion Report, 1976. 199 p., append.

Descriptors: *Electric power costs, *Capital costs, *Financing, Regulation, *Legal aspects, *Permits, *Legislation, Administrative agencies, Federal government, State government, Thermal power, Nuclear powerplants, Hydroelectric plants, Pollution abatement, Coordination, *Electric power demand, *Water law, *Pacific Northwest U.S., *Electric power production.

Volume II of the study examines environmental law as it pertains to the construction of new power plants and the facility licensing process. Legal aspects of the National Environmental Policy Act of 1969, The Clean Air Act Amendments of 1970, The Water Pollution Control Act and The Atomic Energy Act are discussed. The present licensing status of new coal-fire and nuclear facilities in the Northwest are reviewed. Recommendations on legislation to expedite the capitalization and construction of new generating facilities in the Northwest are made. (See also W77-07601).
W77-07602

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. PROTECTION OF AREAS OF ORIGIN, APPENDIX VII,
Wendell and Schwan, Washington, D.C.
For primary bibliographic entry see Field 6D.
W77-07627

ENVIRONMENT AND REGIONAL PLANNING, A PILOT STUDY OF THE COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY,
NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
For primary bibliographic entry see Field 6G.
W77-07633

LAW, RULES, AND REGULATIONS PERTAINING TO GROUNDWATER IN NEBRASKA,
Nebraska Univ., Lincoln. Conservation and Survey Div.
For primary bibliographic entry see Field 4B.
W77-07695

GERMAN POLLUTION CONTROL,
For primary bibliographic entry see Field 5G.
W77-07863

COMMUNITY WATER SUPPLY AND EXCRETA DISPOSAL IN THE DEVELOPING COUNTRIES,
International Reference Centre for Community Water Supply, The Hague (Netherlands).
For primary bibliographic entry see Field 5G.
W77-07865

APPRAISAL OF AREA-WIDE WASTE WATER PLANNING,
Water Resources Engineers, Inc., Springfield, Va.
For primary bibliographic entry see Field 5G.

W77-07874

WATER AND WASTE WATER ENGINEERING FOR LOW INCOME COMMUNITIES IN DEVELOPING COUNTRIES,
For primary bibliographic entry see Field 5G.
W77-07939

THE CURRENT STATE OF ENVIRONMENTAL POLICY,
Senate, Washington, D.C.
For primary bibliographic entry see Field 6G.
W77-08005

6F. Nonstructural Alternatives

AN ANALYSIS OF ALTERNATIVE FLOOD MANAGEMENT PLANS IN UPSTREAM WATERSHEDS. CONNECTICUT RIVER BASIN SUPPLEMENTAL FLOOD MANAGEMENT STUDY, PHASE 2,
Soil Conservation Service, Durham, N.H.
Available from the National Technical Information Service, Springfield VA 22161 as PB-247 343.
Price codes: A06 in paper copy, A01 in microfiche.
New England River Basin Commission, Boston, Mass., June, 1975. 95 p., 23 fig., 15 tab. CRSS-2. 1C; 2. 1D; 2. 1E.

Descriptors: *Flood plains, *Flood protection, *Non-structural alternatives, *Land resources, Water resources, *Connecticut River, Flood control, Economic impact, Flood damage, Water supply, Recreation, Water quality, Air quality, Biological resources, Ecosystem, Geology, Archaeology, Land use, Zoning, Dams, Reservoirs.

Identifiers: *Connecticut River Basin, *Passumpsic River(VT), *Whetstone Brook(VT), *Mill River(MA), *Flood plain management, Land treatment, Flood plain delineation.

Results are provided of a study in which flood management plans in three upstream watersheds in the Connecticut River Basin were analyzed. Information on the formulation of alternative flood management plans, their economic and physical impacts, public responses, and guides to implementation is presented. The three watersheds studied in detail are: the Passumpsic River (VT), Whetstone Brook (VT) and Mill River (MA). Watershed planning should equally weight economic and environmental objectives. These would include factors such as: flood damage reduction, water supply, and recreation as economic considerations; and natural beauty, water quality, air quality, biological resources, ecosystems, and geological, archaeological and historical resources as environmental factors. A plan should be acceptable to those affected by the plan; it should fit into the boundaries of governmental units if the plan addresses land and water resource problems; it should consider land use and water treatment throughout the watershed; it should conform with federal, state and local guidelines; and the plan should be comprehensive. Before any measures are implemented a full inventory of existing flood management system components should be made and a flood plain delineation program carried out. This program would evaluate the impacts from present and future condition flooding with various structural and non-structural flood management measures. (See also W77-01696 thru W77-01694) (Gentry-NC)
W77-07632

FLOOD PLAIN INFORMATION: THOMPSONS CREEK AND TRIBUTARIES, BRYAN, TEXAS,
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-07634

SPECIAL FLOOD HAZARD REPORT: JERSEY CREEK, KANSAS CITY, KANSAS.
Army Engineer District, Kansas City, Mo.
For primary bibliographic entry see Field 4A.
W77-07636

FLOOD PLAIN INFORMATION, SOUTH ANNA RIVER, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-07637

FLOOD PLAIN INFORMATION, NORTH ANNA RIVER, HANOVER COUNTY, VA.
Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-07638

FLOOD PLAIN INFORMATION, CHERRY CREEK-CHERRY CREEK LAKE THROUGH FRANKTOWN, COLORADO.
Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W77-07639

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, WARREN COUNTY, PENNSYLVANIA,
Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-07640

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, VENANGO COUNTY, PENNSYLVANIA,
Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-07641

FLOOD PLAIN INFORMATION: NORTHWEST STREAM GROUP, STOCKTON, CALIFORNIA,
Army Engineer District, Sacramento, Calif.
For primary bibliographic entry see Field 4A.
W77-07642

FLOOD PLAIN INFORMATION: WICHITA RIVER AND TRIBUTARIES, WICHITA FALLS, TEXAS,
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W77-07643

FLOOD PLAIN INFORMATION: IPSWICH RIVER, NORTH READING AND WILMINGTON, MASSACHUSETTS,
Army Engineer District, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 4A.
W77-07644

FLOOD PLAIN INFORMATION: MERRIMACK AND SOUEGAN RIVERS, LITCHFIELD AND MERRIMACK, NEW HAMPSHIRE.
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-07645

IMPLEMENTATION OF NON-STRUCTURAL ALTERNATIVES IN FLOOD DAMAGE ABATEMENT,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
Waldon R. Kerns.
Available from the National Technical Information Service, Springfield VA 22161 as PB-267 305.
Price codes: A06 in paper copy, A01 in microfiche.
Proceedings of a Conference on Informational and Research Needs, held May 24-25, 1976 in Durham,

N.H., co-sponsored by Northeastern Water Center Directors 112 p. Edited by W. R. Kerns and R. C. Underwood. OWRT B-061-R1(2).

Descriptors: *Non-structural alternatives, *Flood damage, Flood control, *Research priorities, Flood plains, *Conferences, Flood protection, *Land management, *Land use, *Alternative planning, Flood plain insurance.

Identifiers: *Flood insurance, *Research needs, Flood risk.

The major thrust of the conference was to identify informational and research needs which would facilitate effective implementation of feasible non-structural alternatives. Four state-of-the-art papers in the plenary session reflect the current status of non-structural implementation and provide a current assessment of informational and research needs to facilitate their implementation. Presentations and discussions in three concurrent workshops consider informational and research needs as related to: (1) flood insurance and rehabilitation programs, (2) land management alternatives, and (3) local implementation. Dave Allee and Mike Walter, Cornell University, discussed flood risk management in the northeastern United States. Douglas James, Utah Water Center, provided an overview of informational needs to facilitate implementation of non-structural alternatives. Madge Ertel, University of Massachusetts, discussed public response to non-structural flood management alternative with specific reference to the Connecticut River Basin Program. J. Ernest Flack, University of Colorado, provides an assessment of research needs on non-structural alternatives. Other papers relate specifically to the three workshop topics. (Kerns-Va. Tech) W77-07795

LOCAL CONTROL OF LAND USE: PROFILE OF A PROBLEM, Wisconsin Univ., Madison. Dept. of Rural Sociology. C. C. Geisler, and O. B. Martinson. Land Economics, Vol. 52, No. 3, p. 371-381, 1976. 5 tab., 30 ref.

Descriptors: *Land use, *Surveys, *Attitudes, *Zoning, Shores, *Land management, Decision making, Agriculture, Planning, Comprehensive planning, *Wisconsin, Rural areas, Rural sociology, Social aspects.

Identifiers: Mobile home zoning.

Several aspects of land use regulation, particularly zoning, were examined in this survey of a population sample residing in four rural northwestern Wisconsin counties. The questions of whether: (1) land use regulation opposition centered on all encroachments on traditional property rights or merely at the government level at which the action accrued; (2) there was marked variation in public opinion as to specific policy components of comprehensive legislation; (3) personal characteristics were related to variations in public attitudes; and, (4) whether an awareness of environmental problems affects land use attitudes. Survey respondents were queried as to whether they favored more zoning restrictions on private lake and riverfront property, strict zoning for mobile homes, and zoning to keep agricultural land from being shifted to other purposes. Survey results indicated that northwest Wisconsin residents were generally supportive of these three zoning policies, but were almost unanimous in the view that these decisions should be made at the local level. Use of multivariate analysis of personal characteristics showed that: (1) as age increased, opposition to shoreland and mobile home zoning tended to disappear, (2) as family income increased, opposition to mobile home zoning and regulation of agricultural lands tended to diminish, and (3) the more aware of environmental problems the respondents were, the less likely they were to oppose shoreland and mobile home zoning. (Luedtke-Wisconsin) W77-08003

6G. Ecologic Impact Of Water Development

A LAND USE DECISION METHODOLOGY FOR ENVIRONMENTAL CONTROL, Rocky Mountain Center on Environment, Denver, Colo.

K. Wickersham, R. P. Hansen, and A. G. Melcher. Available from the National Technical Information Service, Springfield, VA 22161 as PB-244 239. Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/5-75-008, March 1975. 180 p., 7 fig., 4 append. ROAP 21AKL, R802423.

Descriptors: *Land use, *Planning, *Environment, *Alternative planning, *Comprehensive planning, *Ecology, *Decision-making, *Governmental interrelations, Analytic techniques, Institutional constraints, Jurisdiction. Identifiers: *Land use controls, *Land use decision-making system(LUDMS), *Policy planning, Citizen participation, Information systems, Environmental resources inventory, Community programs.

The purpose of the study is to develop an environmentally responsible land use planning and control process that is based on valid technical information used in conjunction with enlightened and informed public opinion, and has legal mechanisms for controlling and implementing actions. A systematic, interdisciplinary environmental analysis and a plan implementation process utilizing the analysis is described. The basic elements of the land use decision-making system (LUDMS) are: policy planning (the system's focal point), which is a process for combining public opinion with scientific and technical information to create community policies; use of an interdisciplinary team; public participation; an environmental resources inventory and analysis; a staff which understands and communicates about ecology; positive community programs; traditional and innovative legal devices for land use control; and model state and local codes for implementing the system. A role is identified for all levels of government that is a compromise between the extreme positions on all sides of the jurisdictional controversy. The report concludes that land use decision-making does not utilize adequate information on the biophysical and sociocultural environment at all levels of government, nor does it involve rigorously constructed relationships between planning and implementation. (Nessa-NC) W77-07629

ENVIRONMENTAL GEOLOGIC ASPECTS OF PLANNING, CONSTRUCTING, AND REGULATING RECREATIONAL LAND DEVELOPMENTS, Wisconsin Dept. of Administration, Madison. State Planning Office.

S. M. Born, and D. A. Stephenson. Upper Great Lakes Regional Commission, Madison, Wisc., An Inland Lake Renewal and Shoreland Management Demonstration Project, Report, January 1974. 39 p., 17 fig., 2 tab., 172 ref.

Descriptors: *Geology, Hydrology, *Recreation, *Water resources, Land, *Land management, *Land use, *Water supply, *Waste disposal, *Environmental effects, *Wisconsin, Climate, Soils, Vegetation, Wildlife, Water table, Water quality, Surface water, Runoff, Lakes, Reservoirs.

Identifiers: Site developability, Earth hazards, *Lakes of the Menominees(WI), *Lake Redstone(WI).

Earth science considerations which are applicable to land use planning in rapidly growing recreational areas are discussed. Case studies included are Lakes of the Menominees and Lake Redstone developments, both in Wisconsin. The report is based on the belief that natural scientists and en-

gineers must contribute their knowledge and ideas to help courts and legislatures make sound decisions and to aid regulatory agencies. Resource inventories and suitability analyses should include physiography, geology, climate, water regime, soils, plant associations, wildlife, land use and unique cultural or natural sites. In site selection design and utilization attention should be given to site developability (meaning structural conditions of the site, availability of construction materials and earth hazards), water supply, waste disposal, water resources for recreation, feasibility of impoundment and impacts of ecological alteration. Hydrological features to be considered are water table position and fluctuation, ground water regime (aquifer characteristics, flow systems, and groundwater quality), surface water regimes (runoff, lakes and wetlands, and surface water quality), and ground water-surface water relationships. It is suggested that geologic factors should be used when regional impacts of development are studied. These studies should (1) predetermine potential sites for development, (2) evaluate aggregate economic and environmental impacts, (3) determine acceptable levels of development, and (4) formulate land-use controls to implement land development policies. (Gentry-NC) W77-07630

ENVIRONMENT AND REGIONAL PLANNING, A PILOT STUDY OF THE COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY, NATO Committee on the Challenges of Modern Society, Brussels (Belgium).

Available from the National Technical Information Service, Springfield VA 22161 as PB-250 396. Price codes: A11 in paper copy, A01 in microfiche. Number 17, 1972. (300 p).

Descriptors: *Planning, *Regional planning, *Decision-making, *Forecasting, *Institutional constraints, *Institutions, *Environment, *Environmental control, Social impact, Regional economics, Value, Social needs, Analytical techniques, *United States.

Identifiers: *NATO, *France, *United Kingdom, *Citizen participation, *Environmental policies, Cultural history, Cultural geography, Historical geography.

Three major themes of regional planning are considered: first, the regional and local institutions responsible for the planning and implementation of environmental policies; second, the means whereby the environment can be given a more important place in national planning decisions; and third, the importance of the specific nature of geographical sites for environmental action. Eighteen case studies from three countries—France, the United Kingdom and the United States—are presented, chosen for individual interest as related to the overall pilot study. The institutional responsibility section deals with the appropriate roles of different levels of government. Citizen participation is stressed as an indicator of local values. The section on means recommends the undertaking of an on-going, accurate assessment of the relationship between the environment and economic and social development, and the establishment of a time link between these phenomena through analytical forecasting. The relationship between quantitative and qualitative analysis is questioned, as is the appropriate timing of decision-making, and the role of the decision-maker. The section on geographical sites evaluates the significance of cultural development in shaping a community's past and future growth. Natural and physical factors are identified as being important in the development of man's living condition and as being influenced by human intervention. Local natural phenomena must be integrated with relevant geographical and social projections. (Nessa-NC) W77-07633

Field 6—WATER RESOURCES PLANNING

Group 6G—Ecologic Impact Of Water Development

FLOOD PLAIN INFORMATION; SAN ANTONIO RIVER, BEXAR COUNTY, TEXAS.
Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-07635

IMPACTS OF OFFSHORE OIL ON NORTH EAST SCOTLAND,
Massachusetts Inst. of Tech. Cambridge.
For primary bibliographic entry see Field 5C.
W77-07752

CITIZEN ATTITUDES TOWARD MANAGEMENT OF THE CHESAPEAKE BAY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6B.
W77-07796

THE ARGO MERCHANT OIL SPILL. A PRELIMINARY SCIENTIFIC REPORT.
National Oceanic and Atmospheric Administration, Washington, D. C. Center for Experiment Design and Data Analysis.
For primary bibliographic entry see Field 5C.
W77-07807

CHANNELIZATION: ENVIRONMENTAL, GEOMORPHIC, AND ENGINEERING ASPECTS,
North Carolina Univ. at Charlotte. Dept. of Geography and Earth Science.
For primary bibliographic entry see Field 8B.
W77-07809

ENVIRONMENTAL POLICY CHOICE UNDER UNCERTAINTY,
Harvard Univ., Cambridge, Mass. Public Policy Program.
W. K. Viscusi, and R. Zeckhauser.
Journal of Environmental Economics and Man, Vol. 3, No. 2, p. 97-112, 1976. 4 fig., 1 tab., 37 ref.

Descriptors: *Risks, *Environmental control, *Environmental effects, *Planning, *Markov processes, Probability, Stochastic processes, Discount rates, Water pollution control.

A Markovian analytical model is developed to help structure situations of environmental policy decision making in which uncertainty plays a critical role. The model is described by a Markov matrix whose entries are transition probabilities which indicate the likelihood that if a system is in a particular state at the present time it will be found in a specified state at some moment of time in the future. Markovian analysis offers great advantage when the alternatives for choice remain identical over time, and when the number of periods is large. Markov chains can be applied to situations where states, policies and time are continuous. An example is given in which Markovian analysis is used with a pollution control model which includes both uncertainty and 'reswitching' (situations in which there is a second reversal in project preference and where it is not possible to state which of two projects is favored as the discount rate is lowered and the future is in effect given greater weight). Demonstrations are also given for using Markovian decision problems involving reswitching policy vectors and policies for particular conditions, applications to irreversibilities (where specific policy choices are pre-empted once particular input decisions have been made), and for uncertainty and policy choice with cost and environmental quality as value attributes. (Harris-Wisconsin)
W77-08004

THE CURRENT STATE OF ENVIRONMENTAL POLICY,
Senate, Washington, D.C.
G. Hart.

Journal of Energy and Development, Vol 1, No 1, p 13-22, 1976. 10 ref.

Descriptors: *Environmental control, *Regulation, *Political constraints, Water pollution control, Federal Water Pollution Control Act, Pollution taxes (Charges), Energy, Economic impact, National income.
Identifiers: National Environmental Policy Act.

Whereas a national consensus at the time of the creation of the National Environmental Policy Act in 1970 dictated that 2-3% of the U.S. gross national product should be committed each year to environmental cleanup, that national commitment has come under increasing attack by 1976 because of two recently-arisen problems: (1) the health of the economy and its downturn since the beginning of the environmental decade; and (2) the need to resolve our mounting energy problems. In answer to the economic argument, it is posited that environmental investment can create jobs, stimulate productivity, and yield profits, even if these investments, jobs and profits are focused on industries taking advantage of environmentally-centered technology. In answer to the energy crisis, it is argued that easing pollution control requirements would not significantly reduce energy consumption or increase domestic production and might, in the long run, result in increased energy demand. Since 1970, Congress has retreated four times under pressure from the auto industry in regard to engine emission standards. It is possible that achieving the complex goals of the 1972 Federal Water Pollution Control Act Amendments might involve the development of a large regulatory bureaucracy. A strategy is needed to replace the current regulatory approach, possibly a pollution tax system. (Harris-Wisconsin)
W77-08005

A NOTE ON THE FAIR DIVISION OF POLLUTION RIGHTS,
Siena Univ. (Italy).
L. M. Tomasi.
Journal of Public Economics, Vol 6, No 3, p 313-317, 1976. 2 ref.

Descriptors: *Regulation, *Relative rights, *Mathematical models, Water pollution control, Law enforcement, Economics, Social aspects, Value, Social values.
Identifiers: *Pollution rights.

In an assessment of what constitutes a fair allocation of pollution rights among a given number of units in a system, a model is described in which account is taken of the problem of defining a concept of fairness which is acceptable from a social point of view. The suggested model can be considered fair or at least acceptable by the units in the economy because (1) the valuation of pollution rights by each unit is subjective; (2) because each unit will obtain at least a share equal in value to the 1/nth of the total population rights; and (3) because if two or more units have different estimations of pollution rights' values, there exists an assignment scheme which gives to each unit more than its fair share. The rule of fair division used in the model can be interpreted as follows: The economy fixes a level of pollution and determines bundles of 'bads' to be allocated fairly among the polluting units. If the central authority fixes a level of pollution such that it can be absorbed into ecosystem, the problem of costs of abatement does not emerge. This does not imply that there are no current costs of pollution, but that these are only short-term costs because after a certain length of time, the ecosystem will return to a zero pollution level. An example is given to illustrate the rule of fair division described in the model. (Harris-Wisconsin)
W77-08006

THE PROBLEM OF THE BEHAVIOR OF CHEMICAL POLLUTANTS IN THE ENVIRONMENT, (IN RUSSIAN),
For primary bibliographic entry see Field 5B.

W77-08028

ENVIRONMENTAL ASSESSMENT: THE ECOLOGICAL DIMENSION,
Ecoplans Ltd., Waterloo (Ontario).
R. S. Dorney.
Journal of the American Water Works Association, Vol. 69, No. 4, p 182-185, April 1977. 1 tab, 8 ref.

Descriptors: *Environment, *Assessment, *Ecology, *Systems analysis, Decision making, Methodology, Water resources, Urban development, Ecosystems, Land.
Identifiers: Historical justification.

An ecology-systems approach based on a three-point philosophy to questions of development, rather than the traditional approach of economic and political expediency and the technological fix, will dominate decision making in the future. Explored are the philosophy and process of environmental assessment. The philosophical dimension for ecology, in the form of a triad, is (1) a reverence for life; (2) a reverence for land; and (3) a reverence for diversity. This philosophical triad distinguishes the ecological approach from other more pragmatic approaches, such as economic determinism. Considered next is the conceptual dimension for ecology; it is a systems approach, that of an ecosystem, where a range of factors are related to each other through a web of relationships. Discussed is a historical justification for development of environmental assessment. A list of 11 items is presented of what an environmental assessment should accomplish. Many of the items require subjective assumptions that create a dilemma when interposed with objective ones. In the systems model or paradigm for environmental assessment, the environment is divided into three subsystems: cultural-historic, abiotic, and biotic. Discussed are organizing an assessment and selecting an appropriate methodology. Seven reasons for making an environmental assessment are given, and the effect and orientation of such an assessment are examined briefly. (Bell-Cornell)
W77-08034

THE VALUATION OF AESTHETIC PREFERENCES,
Wyoming Univ., Laramie. Dept. of Economics.
D. S. Brookshire, B. C. Ives, and W. D. Schulze.
Journal of Environmental Economics and Management, Vol. 3, No. 4, p 325-346, December 1976. 7 fig, 5 tab, 10 ref.

Descriptors: *Estimating, *Aesthetics, *Damages, *Powerplants, *Recreation, Environment Management, Economics, Methodology, Lakes, Surveys, Income distribution, Equations, Systems analysis, *Evaluation.
Identifiers: *Bidding game, *Valuation, Preferences, Theoretical issues, Individual welfare, Social welfare, Utility function, Questionnaires, Siting.

Specification of the benefits of pollution abatement for entire regions remains a difficult and controversial task. Direct costing of damages for losses in productivity, property, and health is still the most accepted methodology, while aesthetic losses associated with deterioration in environmental quality escape direct quantification. The need to quantify the potential aesthetic damage resulting from energy development has become more crucial. Such quantification has been successfully accomplished through a recently developed bidding game technique. This article describes an application of such bidding games to estimate aesthetic damages from possible construction of the Kaiparowits powerplant near Lake Powell in the Glen Canyon National Recreation Area (GCNRA) in Arizona. Emphasis is placed on theoretical problems associated with the application of bidding games as a measure of aesthetic damages in an attempt to develop and then apply

criteria for the validation of the bidding game technique. Three problems associated with the interpretation of bidding games are explored theoretically and empirically: (1) incentives for biased responses; (2) divergences between compensating and equivalent variation; and (3) problems of interpersonal comparison in the aggregation of individual bids. It is concluded that bidding games should play an important role in the future estimation of aesthetic damages. (Bell-Cornell)
W77-08041

A GOAL INTERVAL PROGRAMMING MODEL FOR RESOURCE ALLOCATION IN A MARINE ENVIRONMENTAL PROTECTION PROGRAM.
Texas Univ. at Austin. Center for Cybernetic Studies.
A. Charnes, W. W. Cooper, J. Harrold, K. R. Karwan, and W. A. Wallace.
Journal of Environmental Economics and Management, Vol. 3, No. 4, p 347-362, December 1976. 3 fig, 2 tab, 27 ref.

Descriptors: *Resource allocation, *Environmental control, *Decision making, *Linear programming, Planning, Pollution abatement, Constraints, Equations, Mathematical models, Systems analysis.
Identifiers: *Marine environment, *Goal programming, *Environmental protection programs.

A multidimensional 'goal programming' model is developed to aid resource allocation decisions in the U.S. Coast Guard's Marine Environmental Protection (MEP) program. It is then extended to a model of 'goal interval programming' (GIP) type where exact values for the indicated goals, as in ordinary goal programming, are replaced by ranges. Deviations outside these ranges are also accommodated by piecewise linear functions with slopes that vary with distance from the goal intervals. Uses and generalizations are discussed in the context of applications to allocating manhours and planning the activities of the Coast Guard's MEP program. The application provides the realization that the model has made it possible (a) to obtain a meaningful characterization of measures of effectiveness and their consequences (within limited ranges, within each activity) while also (b) providing a basis for subsequent extensions to other activities needing simultaneous study. (Bell-Cornell)
W77-08042

ADJUSTMENT COSTS AND OPTIMAL WASTE TREATMENT.
State Univ. of New York at Albany. Dept. of Economics.
For primary bibliographic entry see Field 5G.
W77-08045

7. RESOURCES DATA

7A. Network Design

OPTIMAL SPATIAL INTERPOLATION AND ITS ERRORS IN THE CASE OF VARIOUS DISTANCES BETWEEN OBSERVATION POINTS OR WATERSHED CENTRES.
Gosudarstvennyi Gidrolicheskiy Institut, Leningrad (USSR).
For primary bibliographic entry see Field 4D.
W77-07677

MATHEMATICAL PROGRAMMING WITHIN THE CONTEXT OF A GENERALIZED DATA BASE MANAGEMENT SYSTEM.
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W77-07850

7B. Data Acquisition

OPERATING POLICY ADAPTATIONS FOR A RESERVOIR SYSTEMS, (PHASE I).
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-07603

OPERATING POLICY SIMULATION OR A RESERVOIR SYSTEMS, (PHASE II).
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 4A.
W77-07604

14C EVIDENCE FOR THE ORIGIN OF ARID REGION GROUNDWATER, NORTHEASTERN PROVINCE, KENYA.
Geological Survey, Reston, Va. Water Resources Div.
F. J. Pearson, Jr., and W. V. Swarzenki.
In: Isotope Techniques in Groundwater Hydrology 1974, Vol II, p 95-109, 1974: International Atomic Energy Agency, Vienna, Austria, 1974. 5 fig, 2 tab, 9 ref.

Descriptors: *Groundwater, *Dating, *Carbon radioisotopes, *Hydrogeology, *Africa, Arid lands, Analytical techniques, Evaluation, Water chemistry.
Identifiers: *Kenya, *Carbon-14.

A major natural resource of the arid Northeastern Province of Kenya is a body of fresh groundwater underlying the drainage-ways of the Ewaso Ng'iro River and Lagh Dera for about 200 km southeast and east of Habaswein. Twenty samples of this fresh water and surrounding saline water have been analysed for their chemical and radio and stable carbon isotopic composition to investigate mechanisms of recharge of the fresh-water body. No samples contain detectable tritium, and measured C-14 contents range from 2.8 to 87.7% modern. The higher measured C-14 values are associated with the fresher water body, but there is no strict correlation between C-14 and salinity. The different C-14 contents within each group are due to additions of varying amounts of C-14 free carbonate (by aquifer carbonate solution or mixing with older water) to water from a single recharge event. Because of lack of general knowledge about arid region carbonate chemistry and lack of samples to show chemical and isotopic variations with depth in the aquifer, no absolute ages were assigned to these waters. It is probable, though, that the recharge events occurred at intervals of a few millennia. (Woodard-USGS)
W77-07611

VERIFICATION BY REMOTE SENSING OF AN OIL SLICK MOVEMENT PREDICTION MODEL.
Delaware Univ., Lewes. Marine Studies Complex.
For primary bibliographic entry see Field 5B.
W77-07745

SEDIMENT MEASUREMENT IN ESTUARINE AND COASTAL AREAS.
EG and G Washington Analytical Services Center, Inc., Rockville, Md.
For primary bibliographic entry see Field 2L.
W77-07748

FRITTED GLASS BEAD MATERIALS AS TENSOMETERS AND TENSION PLATES.
Newfoundland Forest Research Centre, St. John's.
For primary bibliographic entry see Field 2G.
W77-07760

ICE MOVEMENTS IN THE BEAUFORT SEA 1973-1975: DETERMINATION BY ERTS IMAGERY.
Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
For primary bibliographic entry see Field 2C.
W77-07769

THE ERRORS INVOLVED IN INFERRING SALINITY FROM SOUND VELOCITY.
Texas A and M Univ., College Station. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W77-07774

THE USE OF LYSIMETERS IN THE HYDROLOGICAL INVESTIGATION OF THE UNSATURATED ZONE.
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 2D.
W77-07780

ANALYSIS OF IFYGL RAWINSONDE BASELINE MEASUREMENTS.
National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service; National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
For primary bibliographic entry see Field 2B.
W77-07790

APPARATUS FOR PROLONGED MAINTENANCE OF SPECIFIC GAS CONCENTRATION IN THE WATER OF EXPERIMENTAL AQUARIA.
Akademiya Nauk URSS, Kiev. Instytut Hidrobiologii.
N. T. Kotsar.
Hydrobiological Journal, Vol 11, No 6, p 84-87, 1975. 1 fig, 3 ref.

Descriptors: Equipment, *Gases, *Design, Laboratory tests, *Methodology, *Laboratory equipment, *Dissolved oxygen, *Aeration, *Air environment, Water properties, Carbon dioxide, *Aquaria.
Identifiers: *Dissolved gases, *Partial pressure, USSR.

An apparatus is described which allows for the maintenance of specific gas concentrations in water of aquaria. The apparatus is designed according to the principle that the composition of the gas phase governs the concentration of dissolved gases in a liquid which is in equilibrium with the gas phase. It consists of a Plexiglas cover which isolates the surface water from the atmosphere and microcompressors which provide rapid circulation of the gas mixture from the air space into the water. Water samples for analysis and fish are inserted through a well. A Kipp apparatus, electrolyzer, and a system of washing and gas-metering chambers are used to fill the enclosed space with gases of specific compositions. (Katz)
W77-07841

THE APPLICATION OF ERTS-1 DIGITAL DATA TO WATER TRANSPORT PHENOMENA IN THE POINT PEELE-RONDEAU AREA.
For primary bibliographic entry see Field 2J.
W77-07981

LOW FREQUENCY TURBULENCE AND VERTICAL TEMPERATURE MICROSTRUCTURE IN LAKE TAHOE, CALIFORNIA-NEVADA.
For primary bibliographic entry see Field 2H.
W77-07984

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

GRAVITY-MEASURING DEVICE FOR WATER AND MINERAL DETECTION,

J. N. Preston.
U.S. Patent No. 3,991,625, 4 p, 2 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 952, no 3, p 994, November 16, 1976.

Descriptors: *Patents, *Groundwater, *Groundwater availability, Gravity studies, Measurement, Physical properties, Electrical equipment.

The invention is comprised of an electric motor and generator whose moving parts are connected to each other by torque-transmitting means so that the torque of the electric motor and the resistance of the electric generator operates to lift either the electric motor or generator for a distance against the force of gravity. The distance is determined by a mercury-type electric switch and the differences in gravity at different places above the earth are measured both by a motor ampmeter and a generator ampmeter to detect minerals and water beneath the surface of the earth. (Sinha-OEIS)
W77-08010

LIQUID SAMPLER,

A. J. Czarniecki.
U.S. Patent No. 3,994,170, 4 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 952, no 5, p 1951, November 30, 1976.

Descriptors: *Patents, *Sampling, *Water sampling, Measurement, On-site investigations, Water pollution, Water pollution control, Equipment, Automation, Bodies of water.

The object of the invention is to provide a simple, and effective liquid sampler which is capable of collecting samples of liquid from the entire cross-section, including the surface waters, of conduits or streams in a single operation and to provide a sampler which will take varying quantities of the sample stream, depending on the streams flow automatically. The liquid sampler comprises: a generally cylindrical tubular container having a closed bottom end; a longitudinal opening in its wall; a generally cylindrical tubular member mounted for rotation with respect to the container about the longitudinal axis; and a spiral opening in it extending about the periphery. The container and the tubular member are rotated so that the longitudinal opening and the spiral opening coact to provide an aperture moving longitudinally to permit the collection of liquid from varying depths of the body of water. The longitudinal slot may be rectangular or it may be increasingly tapered from the bottom of the container towards the top to compensate for the higher pressures at greater depths of the body of water so that equal volumes are collected from all depths. (Sinha-OEIS)
W77-08024

ELECTRICAL RESISTIVITY MEASUREMENTS ON THE ROSS ICE SHELF,

Wisconsin Univ. Madison. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2C.
W77-08051

ENERGY EXCHANGE AT A GLACIER SURFACE: AN ALTERNATIVE TO AERODYNAMIC METHODS OF MEASUREMENT,

British Antarctic Survey, Cambridge (England).
For primary bibliographic entry see Field 2C.
W77-08053

A TECHNIQUE TO INDEX SOIL PORES AND AGGREGATES LARGER THAN 20 MICROMETERS,

Agricultural Research Service, Salinas, Calif.
For primary bibliographic entry see Field 2G.
W77-08059

THE MEASUREMENT OF RAINFALL AT GROUND LEVEL,

Department of Scientific and Industrial Research, Lower Hutt (New Zealand). Soil Bureau.
For primary bibliographic entry see Field 2B.
W77-08061

PROCEEDINGS OF THE NASA EARTH RESOURCES SURVEY SYMPOSIUM, JUNE 1975, TECHNICAL SESSION PRESENTATIONS, WATER RESOURCES, VOLUME I-D,

National Aeronautics and Space Administration, Houston, Tex. Lyndon B. Johnson Space Center. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, September 1975 (3 Vol.). 535 p. Smistad, O., Coordinator.

Descriptors: *Conferences, *Remote sensing, *Water resources, *Surveys, *Satellites(Artificial), Water quality, Land use, Groundwater resources, Surface waters, Runoff, Snow surveys, Water management(Applied), Reservoirs, Rivers, Mixing, Floods, Soil moisture.
Identifiers: LANDSAT, Skylab.

The symposium reported herein combined the utilization and results of data from NASA programs involving LANDSAT, the Skylab Earth resources experiment package, and aircraft as well as information from other data acquisition programs. The primary emphasis was on the practical applications of Earth resources survey technology of interest to a large number of potential users. Also featured were scientific and technological exploration and research investigations with potential applications. Technical sessions presentations were structured to provide governmental and private organizations with a comprehensive picture of various applications in the management and implementation of remote-sensing data use in their own programs. Volume I-D contained technical papers related to water resources and water resources management. (See W77-08063 thru W77-08084) (Humphreys-ISWS)
W77-08062

THE USE OF SKYLAB AND LANDSAT IN A GEOHYDROLOGICAL STUDY OF THE PALEOZOIC SECTION, WEST-CENTRAL BIGHORN MOUNTAINS, WYOMING,

Wyoming Univ., Laramie. Dept. of Geology.
B. J. Tomes.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2167-2182, September 1975. 9 fig, 1 tab, 11 ref.

Descriptors: *Remote sensing, *Wyoming, *Surveys, *Hydrogeology, Groundwater recharge, Natural recharge, Base flow, Satellites(Artificial), Terrain analysis, Mapping, Geologic mapping.
Identifiers: *Bighorn Mountains, LANDSAT, Skylab.

Sites of geologic structures were identified using Skylab and LANDSAT imagery, and their relationships to groundwater recharge and discharge were studied. The study area lay along the western slope of the Bighorn Mountains, Wyoming. It was found that runoff flowing from the Precambrian core of the Bighorn Mountains sinks as it flows over outcrops of the Bighorn dolomite. A comparison of photo-geologic maps prepared from Skylab and LANDSAT imagery and a geologic map compiled by Darton (1906) illustrated that photomapping, by itself, cannot supply adequate detail, but it can supplement reconnaissance mapping. Lineation maps were compiled from LANDSAT and Skylab images and compared to similar maps compiled by other investigators. Many of the lineations are expressions of tectonic activity that affect fractures and, consequently, groundwater recharge. Hydrologic features, in the

form of sinks and springs, on four creeks in the study area were located on the lineation maps, and their relationships to the lineation were observed. A direct correlation exists between mapped lineations and the hydrologic features. A comparison of the interpretations of other investigators, made independently of the geohydrological study, also showed a direct correlation. This observation indicates direction of movement. The quantity of groundwater recharge and discharge, expressed as fracture concentration, may be estimated by comparing lineation maps to drainage and geologic maps in areas where groundwater movement is fracture controlled. (See also W77-08062) (Humphreys-ISWS)
W77-08063

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,

Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
W. Kruck, and W. Kantor.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2183-2197, September 1975. 6 fig, 3 ref.

Descriptors: *Hydrogeology, *Remote sensing, *Surveys, Evaluation, Terrain analysis, Water supply, Water resources, Surface waters, Soil types, Foreign countries, Foreign waters, Foreign research.
Identifiers: *Argentinian Pampa, *Bajos, LANDSAT, Skylab.

In large areas of the Argentinian Pampa, the salinization of groundwater creates water supply difficulties. Investigations of satellite imagery (Landsat-1 and Skylab), which were based on an extensive ground survey, revealed that differences in the vegetation cover are closely related to depth and salinity of groundwater. Narrow elongated depressions called 'bajos' are often the only indication of fresh groundwater. They can easily be detected on the imagery. Due to their high resolution, Skylab photos allow a quantitative estimation of fresh groundwater situated below the bajos. In general, however, Landsat-1 imagery sufficed for evaluation. In the area of the Rio Tercero, a fossil drainage pattern was discovered, and in Corrientes province, soil types could be discriminated and compared to the SOIL MAP OF THE WORLD. It was concluded that the use of satellite imagery in the future will reduce the number of observation points for hydrogeological reconnaissance mapping by up to 75% in areas with similar hydrogeological conditions. (See also W77-08062) (Humphreys-ISWS)
W77-08064

URBAN LAND USE: REMOTE SENSING OF GROUNDWATER PERMEABILITY,

California Univ., Santa Barbara. Geography Remote Sensing Unit.
L. R. Tinney, J. R. Jensen, and J. E. Estes.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2199-2206, September 1975. 3 fig, 3 tab, 4 ref.

Descriptors: *Remote sensing, *California, *Water resources, *Groundwater, Land use, Groundwater recharge, Groundwater resources, Pervious soils, Watersheds(Basins), Groundwater availability, Urbanization, Evaluation, Aerial photography, Permeability.

A remote sensing analysis of the amount and type of permeable and impermeable surfaces overlying an urban recharge basin was discussed. An effective methodology for accurately generating this data as input to a safe yield study was detailed and

compared to more conventional alternative approaches. The amount of area inventoried, approximately 10 sq miles, should provide a reliable base against which automatic pattern recognition algorithms, currently under investigation for this task, can be evaluated. If successful, such approaches can significantly reduce the time and effort involved in obtaining permeability data, an important aspect of urban hydrology dynamics. (See also W77-08062) (Humphreys-ISWS)
W77-08065

MICROWAVE REMOTE SENSING OF SOIL MOISTURE

Kansas Univ., Lawrence.
F. T. Ulaby, P. P. Batlivala, J. Cihlar, and T. Schmugge.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2207-2232, September 1975. 24 fig, 12 ref.

Descriptors: *Remote sensing, *Soil moisture, *Vegetation effects, *Kansas, *California, Moisture content, Soil temperature, Aerial photography, Evaluation, Measurement, Satellites(Artificial), Corn(Field), Soybeans, Microwaves, Radiation.
Identifiers: Nimbus-5.

Plant growth, partitioning of rainfall into surface runoff and infiltration components, and evaporation loss to the atmosphere, among other processes, all depend on the amount of water present in the soil. This paper examined the potential application of microwave remote sensing devices in estimating soil moisture content over extended areas. Experimental measurements involving both active and passive microwave sensors acquired from a variety of platforms were presented. Evaluation of the total available experimental data acquired by microwave sensors from ground-based, airborne, and spaceborne platforms revealed that, under the majority of surface cover conditions, microwave sensors are capable of detecting soil moisture variations. The accuracy associated with a quantitative determination of moisture content is, however, subject to the choice of sensor parameters (frequency, incidence angle, and polarization) and to ground conditions (surface roughness, vegetation cover, and soil temperature). It was concluded that continued work towards an operational satellite soil moisture mapping system involves the establishment of optimum sensor (active and passive)/sensor parameter combination(s) and testing over a wide range of terrain characteristics. (See also W77-08062) (Humphreys-ISWS)
W77-08066

SOIL MOISTURE DETECTION FROM SKYLAB

Kansas Univ., Lawrence.
J. R. Eagleman, and W. C. Lin.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2233-2241, September 1975. 8 fig, 5 ref.

Descriptors: *Remote sensing, *Soil moisture, *Satellites(Artificial), Measurement, Evaluation, Aerial photography, Microwaves, On-site investigations, Basic data collections, Surveys, Moisture content.
Identifiers: Skylab, Nimbus-5.

An investigation was designed for the Skylab satellite to determine the feasibility of remote sensing of the soil moisture content of the surface from various microwave sensors. Skylab data for the experiment were collected during passes 5, 10, 16, and 38 across the two test sites selected in east-

ern Kansas and western Texas. Pass 38 covered both test sites, giving five data sets for the analysis. As Skylab data were being taken, the moisture content of the soil was sampled by ground crews for each 2.5 centimeter depth from the surface to 15 centimeters at interval of about 6 kilometers along two different routes in the test sites. Skylab data were collected by passive microwave radiometers at wavelengths of 2.1 and 21 cm by the S193 and S194 microwave sensors. An active microwave system also collected scatterometer data at a wavelength of 2.1 cm. Aircraft underflights and a Nimbus-5 satellite provided additional data from microwave sensors corresponding to the Skylab passes. The analysis of microwave data revealed that the longer wavelength L-Band passive radiometer gave the best correlation with soil moisture content of the upper 2.5 cm depth of soil. These correlations were quite good and were apparently influenced very little by other factors such as terrain, vegetation, and cloud cover, with the only major disadvantage of the L-Band radiometer being the size of the resolution cell. The shorter wavelength radiometers were influenced more by cloud cover and vegetation, but they did have the advantage of a smaller size of resolution cell. The relationship between the soil moisture content and the radiometric antenna temperature was used to calculate soil moisture levels from satellite altitudes with several applications suggested by this capability. (See also W77-08062) (Humphreys-ISWS)
W77-08067

THE CORRELATION OF SKYLAB L-BAND BRIGHTNESS TEMPERATURES WITH ANTECEDENT PRECIPITATION

Oklahoma Univ., Norman.
M. J. McFarland.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2243-2252, September 1975. 5 fig, 21 ref. NAS 9-13360.

Descriptors: *Remote sensing, *Soil moisture, *Satellites(Artificial), Measurement, Evaluation, Microwaves, Radiation, Antecedent precipitation, Antecedent moisture content, Soil moisture, Moisture content.
Identifiers: Skylab.

The S194 L-band radiometer flown on the Skylab mission measured terrestrial radiation at the microwave wavelength of 21.4 cm. The terrain emissivity at this wavelength is strongly dependent on the soil moisture content, which can be inferred from antecedent precipitation. For the Skylab data acquisition pass from the Oklahoma panhandle to southeastern Texas on 11 June 1973, the S194 brightness temperatures were highly correlated with antecedent precipitation from the preceding eleven day period, but very little correlation was apparent for the preceding five day period. The correlation coefficient between the averaged antecedent precipitation index values and the corresponding S194 brightness temperatures between 230 K and 270 K, the region of apparent response to soil moisture in the data, was -0.97. The equation of the linear least squares line fitted to the data was: $API (cm) = 31.99 - 0.114 T$, where API is the antecedent precipitation index and T is the S194 brightness temperature. (See also W77-08062) (Humphreys-ISWS)
W77-08068

FLOOD HAZARD STUDIES IN CENTRAL TEXAS USING ORBITAL AND SUBORBITAL REMOTE SENSING IMAGERY

Texas Univ., Austin. Dept. of Geological Sciences.
V. R. Baker, R. K. Holz, and P. C. Patton.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Re-

port No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2253-2294, September 1975. 27 fig, 2 tab, 30 ref, 1 append. NAS 9-13312.

Descriptors: *Remote sensing, *Mapping, *Geomorphology, *Texas, *Floods, Watersheds(Basins), Flood plains, Hydrographs, Satellites(Artificial), Small watersheds, Channel morphology, Distribution patterns, Channels, Drainage density, Topography.
Identifiers: Skylab, *Colorado River(Tex).

One approach to flood hazard evaluation in the central Texas area is a parametric model which relates flood hydrograph characteristics to quantitative geomorphic properties of the drainage basins. The study evaluated the network resolution capabilities of the following data formats: (1) large-scale (1:24,000) topographic maps, employing Strahler's method of v's, (2) standard low altitude black and white aerial photography (1:13,000 and 1:20,000 scales), (3) NASA-generated aerial infrared photography at scales ranging from 1:48,000 to 1:123,000, and (4) Skylab Earth Resources Experiment Package S-190A and S-190B sensors (1:750,000 and 1:500,000 respectively). Resolution, measured as the number of first order streams or as the total channel length identified in small drainage areas, is strongly dependent on basin relief. High-density basins on the Edwards Plateau were poorly depicted on orbital imagery. However, the orbital network definition of low relief basins on the inner Texas Coastal Plain is nearly as accurate as results from large-scale topographic maps. The Skylab earth terrain camera (S-190B) and NASA-generated aerial infrared type 2443 imagery at 1:48,000 scale were found to be useful for botanic soils, and geomorphic flood hazard zonation. Studies of the Colorado river valley near Austin, Texas, easily distinguished infrequent (100 to 500 year recurrence interval), intermediate (10-30 year), and frequent (1 to 4 year) hazard zones. (See also W77-08062) (Humphreys-ISWS)
W77-08069

REMOTE SENSING OF MISSISSIPPI RIVER CHARACTERISTICS

Colorado State Univ., Fort Collins.
J. F. Ruff, M. M. Skinner, B. R. Winkley, D. B. Simons, and D. E. Dorratague.
In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2299-2315, September 1975. 9 fig, 4 ref.

Descriptors: *Remote sensing, *Mississippi River, *Hydrography, *On-site data collections, Surveys, Surface waters, Aerial photography, Mapping, On-site investigations, Hydrologic aspects, Currents(Water), Topography, Sediment distribution, Sediment transport, Discharge(Water), Channels, Flow, Evaluation, Analysis, Vegetation, Rivers, Floods.

Aerial infrared photography and thermal infrared imagery from an aircraft platform were obtained over two selected reaches of the Mississippi River. Interpretation of the photography and imagery was performed to identify river characteristics pertaining to the flow, sediment concentration, and geometry. The remotely sensed data, coupled with ground truth data, can give an overview of large rivers that can be used for maintenance and design. Subsurface phenomena can be deduced from features observed at the water surface. Surface flow patterns are evident on all types of photography, but color infrared photography is most effective where suspended material concentration differences exist. Shear zones, mixing zones, regions of high velocity flow, slack water areas, and localized flow patterns can be identified. The effect of man-made structures on the flow patterns is identifiable. Specular reflection indicates the portion of the river that has the

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

most turbulence, the highest velocities, and the highest sediment transport. When using specular reflection as an interpretative key, prudent judgment must be exercised. A 1:20,000 scale provided sufficient detail for interpretation of flow patterns. A qualitative evaluation of the sediment transport and flow can be made at a given stage based upon flow patterns at the surface, the local boundary geometry, and the overall geometry. Mosaics of color infrared prints for reaches of the river are very useful for establishing the planimetric characteristics of the channel, for evaluating the overall effect of structures, for observing the pool-crossing-pool sequence, for locating sources and sinks of sediment, and for documenting and evaluating the general behavior of the river. As flow stage changes, the shifting of the thalweg can be identified. (See also W77-08062) (Humphreys-ISWS)

W77-08070

APPLICATION OF THERMAL SCANNING TO THE STUDY OF TRANSVERSE MIXING IN RIVERS.

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 5B.

W77-08071

UTILIZATION OF LANDSAT DATA FOR WATER QUALITY SURVEYS IN THE CHOP-TANK RIVER.

General Electric Co., Beltsville, Md.

For primary bibliographic entry see Field 5A.

W77-08072

HYDROLOGIC LAND USE CLASSIFICATION OF THE PATUXENT RIVER WATERSHED USING REMOTELY SENSED DATA.

General Electric Co., Beltsville, Md.

W. C. Dallam, A. Rango, and L. Shima.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2351-2364, September 1975. 7 fig, 1 tab, 7 ref.

Descriptors: *Land use, *Remote sensing, *Hydrologic aspects, *Maryland, *Watersheds(Basins), Aerial photography, Surveys, *Classification, Analytical techniques, *Land classification, Forests, Surface waters, Wetlands, Pastures, Urban mapping, Evaluation, Flood plains.

Identifiers: *Patuxent River, LANDSAT, Multispectral analysis.

The Patuxent River Watershed, located in central Maryland between Baltimore and Washington, D.C. is approximately 2330 sq km in area and 175 km long. This region is not at a critical point because of concerns such as water management and quality, flooding, and land use within the watershed. Data from the NASA-directed LANDSAT and Earth Resources Aircraft Programs have been used to provide a new dimension in information collection and processing for the management of watersheds. Digital data from LANDSAT-1, ID number 1260-15201, were analyzed along with selected IR photography from U-2 flight number 74-060B taken 28 April 1974, which was digitized in three channels. Processing of the data was accomplished using a multispectral analysis system. Land use themes consisting of surface water, wetlands, forest, residential, cropland/pasture, urban, and extractive were developed and delineated through the watershed. Area measurements of watershed themes were obtained and will serve as a calibration input to a deterministic hydrologic model on a sub-watershed. Using the derived residential and urban theme areas from LANDSAT, an estimated basin imperviousness was also calculated. Thematic maps were produced at 1:62,500 scale. Floodprone areas were also classified and delineated at a scale of 1:24,000. Comparison with

standard floodprone area maps at the same scale has indicated a few areas of discrepancy. Such information can be used for updating or checking floodprone area boundaries as well as monitoring changes in floodplain areas. This cooperative study has provided participating state and local agencies with remote sensing information as applied to hydrologic problems and has resulted in a technology exchange. (See also W77-08062) (Humphreys-ISWS)

W77-08073

LAND USE CLASSIFICATION FOR HYDROLOGIC MODELS USING INTERACTIVE MACHINE CLASSIFICATION OF LANDSAT DATA.

Maryland Univ., College Park. Dept. of Civil Engineering.

T. J. Jackson, R. M. Ragan, and R. H. McCuen.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2365-2378, September 1975. 5 fig, 4 tab, 4 ref, 1 append.

Descriptors: *Land use, *Remote sensing, *Hydrologic aspects, *Maryland, *Watersheds(Basins), Aerial photography, Surveys, Land classification, Analytical techniques, Forests, Wetlands, Agriculture, Land, Pastures. Identifiers: *Anacostia River, LANDSAT, Multispectral analysis.

Models designed to simulate the hydrology of urban areas require input parameters describing the land use and degree of imperviousness of the watershed. Unfortunately, the magnitude and spatial distribution of these parameters are rather difficult to estimate when a large watershed is involved. Trade-offs between accuracy of the model parameters and the time or money available for their determination must be made. Because of the necessity of such trade-offs, a study was developed to investigate the use of computer aided analysis of LANDSAT multispectral data in estimating percent of imperviousness and associated land uses needed in urban hydrologic modeling. An interactive computer was used to delineate seven land use classifications in the 342 sq km Maryland portion of the Anacostia River Basin from LANDSAT data. These results compared favorably with those of an earlier study which obtained the same information through analysis of aerial photographs which had a scale of 1:4800. Approximately 94 man days were required to complete the land use analysis using the aerial photographs, while less than three man days were required to accomplish similar tasks using the LANDSAT data. (See also W77-08062) (Humphreys-ISWS)

W77-08074

REMOTE SENSING TECHNIQUES FOR PREDICTION OF WATERSHED RUNOFF.

Texas A and M Univ., College Station.

B. J. Blanchard.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2379-2406, September 1975. 5 fig, 1 tab, 5 ref.

Descriptors: *Remote sensing, *Runoff coefficient, *Watersheds(Basins), *Oklahoma, Runoff forecasting, Runoff, Land classification, Analytical techniques, Analysis, Aerial photography, Satellites(Artificial), Small watersheds, Agricultural watersheds.

Identifiers: *Chickasha(Okla), LANDSAT.

The advent of new remote sensing devices developed in the past decade offers the possibility that watershed characteristics, such as vegetative cover, soils, soil moisture, etc., may be quantified

rapidly and economically. Experiments with visible and near infrared data from the LANDSAT-1 multispectral scanner have indicated that a simple technique for calibration of runoff equation coefficients is feasible. When tested on 10 watersheds in the Chickasha, Oklahoma area, the technique using LANDSAT data produced more accurate runoff coefficients than conventional methods. A similar approach was used to relate passive microwave antenna temperatures to runoff equation coefficients by using data from the Passive Microwave Imaging System mounted in the NASA P3A aircraft. Eight highly instrumented watersheds in the Chickasha study area were used. Study of these data and the data systems indicated that passive microwave antenna temperatures may be more effective throughout the year for calibration of watershed runoff coefficients than systems using visible and near infrared light. (See also W77-08062) (Humphreys-ISWS)

W77-08075

THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION.

Army Engineer District, Waltham, Mass. New England Div.

S. Cooper, P. Bock, J. Horowitz, and D. Foran.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2443-2522, September 1975. 25 fig, 5 tab, 3 ref.

Descriptors: *Remote sensing, *Water management(Applied), *New England, *Surface waters, Water resources, Floods, Instrumentation, Management, Operations, Networks, Satellites(Artificial), Hydrologic data, Data processing, Monitoring, Surveys, Mapping, Photography, Ice, Snow cover, Lakes, Rivers, Water quality, Evaluation.

Identifiers: *Data collection systems, *Data collection platforms, LANDSAT.

The New England Division (NED), Corps of Engineers has experimented with the LANDSAT-1 Data Collection and Imaging Systems for more than two years following the launch of the satellite in July 1972. The purpose of this experiment has been to evaluate the future usefulness of data products received from satellites such as LANDSAT in the day-to-day operation of the NED water resources systems used to control floods. NED concluded that data collection by orbiting satellite relay is both reliable and feasible. Using standard photo equipment, experience in this investigation has indicated that LANDSAT photo imagery may be enlarged about five times, or to a scale of 1:200,000. This is sufficient for only rather large-scale or gross feature patterns to be represented with the accuracy necessary for flood control reservoir regulation purposes. This study has indicated technological feasibility, albeit with the expectation of further advances in imaging systems and products. Pilot project test and evaluation demonstrations under quasi-operational conditions were recommended. (See also W77-08062) (Humphreys-ISWS)

W77-08076

THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE INVENTORY OF PLAYA LAKES IN THE HIGH PLAINS OF TEXAS.

Texas Water Development Board, Austin.

A. W. Wyatt, M. L. Ellis, and A. E. Bell.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2523-2530, September 1975. 16 ref.

Descriptors: *Remote sensing, *Playas, *Texas, *Projects, Data collections, Water management(Applied), *Lakes, Surface waters, Water resources, Programs, Project planning, Water resources development, Surface water availability, Groundwater, Groundwater recharge, Satellites(Artificial).
Identifiers: *High Plains(Tx), LANDSAT.

The Texas Water Development Board is planning a project to determine the feasibility of using LANDSAT digital data to inventory the playa lakes of the High Plains region of Texas. The project will use the Detection and Mapping package developed at NASA-Johnson Space Center. The economy of the High Plains region is dependent on groundwater for irrigation, and the Ogallala aquifer is being depleted faster than it is being recharged. The playa lakes represent a potential source of artificial recharge for the aquifer, and an inventory is the first step in that direction. (See also W77-08062) (Humphreys-ISWS)
 W77-08077

REMOTE SENSING APPLICATIONS IN WATER RESOURCES MANAGEMENT BY THE CALIFORNIA DEPARTMENT OF WATER RESOURCES,

California State Dept. of Water Resources, Sacramento.
 B. Brown.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2531-2560, September 1975. 4 tab.

Descriptors: *Water resources, *Remote sensing, *California, *Data collections, Water resources development, Water, Planning, Mapping, Hydrologic data, Satellites(Artificial), Aerial photography, Surveys, Costs, Land use, Cost comparisons.
Identifiers: LANDSAT.

For nearly 30 years, the California Department of Water Resources has been using remote sensing techniques in all phases of planning, constructing, and operating various features of the California Water Plan. Most of this experience has been with low altitude aerial photography. Recently, the Department has initiated a program to evaluate possible applications of imagery from high altitude aircraft and satellite sensors. Results from seven applications studies, which compared the costs of using high altitude imagery for various purposes to the costs of using conventional data sources, revealed the high altitude imagery to be more cost effective in six cases and equal to conventional data sources in one case. The results also revealed that the imagery provides a level of quality not generally achievable with uncorrected, conventional imagery. Although satellite application studies are not yet complete, preliminary results indicate that some definite possibilities exist for employing satellite imagery on an operational basis within the next few years. (See also W77-08062) (Humphreys-ISWS)
 W77-08078

EVALUATION OF THERMAL X/5-DETECTOR SKYLAB S-192 DATA FOR ESTIMATING EVAPOTRANSPIRATION AND THERMAL PROPERTIES OF SOILS FOR IRRIGATION MANAGEMENT,

South Dakota State Univ., Brookings. Remote Sensing Institute.
 D. G. Moore, M. L. Horton, M. J. Russell, and V. I. Myers.
 In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2561-2583, September 1975. 7 fig, 5 tab, 14 ref. NASA NAS 9-13337.

Descriptors: *Evapotranspiration, *Remote sensing, *Data processing, *Texas, Data collections, Evaluation, Analysis, Land use, Irrigated land, Soil moisture, Soil temperature, Management, Energy budget, Satellites(Artificial), Aerial photography.
Identifiers: Skylab.

An energy budget approach to evaluating the SKYLAB X/5-detector S-192 data for prediction of soil moisture and evapotranspiration rate was pursued. A test site which included both irrigated and dryland agriculture in Southern Texas was selected for the SL-4 SKYLAB mission. Both vegetated and fallow fields were included. Data for a multistage analysis, including ground, NC-130B aircraft, RB-57F aircraft, and SKYLAB altitudes, were collected. Ground data were used to characterize energy budgets and to evaluate the utility of an energy budget approach for determining soil moisture differences among twelve specific agricultural fields. It was concluded that: (1) Wavelengths greater than 1.5 micrometers were required to spectrally distinguish between wet and dry fallow surfaces. (2) The thermal data provided a better estimate of soil moisture than did the reflective bands. (3) Thermal data was dependent on soil moisture, but not on the type of agricultural land use. (4) The emittance map, when used in conjunction with existing models, did provide an estimate of evapotranspiration rates. (5) Surveys of high soil moisture areas can be accomplished with space-altitude thermal data. If both soil moisture and land use are to be surveyed, at least one reflective channel must be included in the analysis. (6) Thermal data will provide a reliable input into irrigation scheduling. (7) The thermal and spatial resolution of the S-192 X/5 detector SKYLAB data is appropriate for monitoring soil moisture and for irrigation scheduling. (8) The time of data collection for soil moisture surveys should be close to midday. (See also W77-08062) (Humphreys-ISWS)
 W77-08079

REMOTE SENSING INPUTS TO WATER DEMAND MODELING,

California Univ., Santa Barbara. Geography Remote Sensing Unit.

J. E. Estes, J. R. Jensen, L. R. Tinney, and M. Rector.
 In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2585-2620, September 1975. 8 fig, 8 tab, 4 ref.

Descriptors: *Model studies, *Hydrologic budget, *California, *Remote sensing, Water demand, Data processing, Mapping, Crops, Land use, Water balance, Agriculture, Irrigation, Census, Saline soils, Aerial photography.
Identifiers: *Kern County(Calif), LANDSAT.

Water resource managers require timely, accurate, and cost-effective data to model hydrologic dynamics in arid agricultural environments. In an attempt to determine the ability of remote sensing techniques to economically generate data required by water demand models, a water model was developed for Kern County Water Agency (KCWA), California. The model is currently being refined. Based upon an analysis of the KCWA model, listings of all external quantities that serve as inputs to the model were compiled and analyzed in the following manner: (1) all data inputs were precisely defined; (2) related data inputs were grouped and categorized; (3) present sources of input data were identified; and (4) preliminary determinations were made as to which inputs could possibly be generated more efficiently utilizing remote sensing technology. As a result of this analysis, it was determined that agricultural cropland inventories utilizing both high altitude photography and LANDSAT imagery can be conducted cost-effectively. In addition, by using

average irrigation application rates in conjunction with cropland data, estimates of agricultural water demand can be generated. Techniques developed are considered economical, accurate, and timely in comparison to conventional methods. (See also W77-08062) (Humphreys-ISWS)
 W77-08080

AREAL EXTENT OF SNOW ESTIMATION IN THE NORTHERN SIERRA NEVADA MOUNTAINS USING LANDSAT-1 IMAGERY,

California Univ., Berkeley. Remote Sensing Research Program.

E. F. Katibah.
 In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2621-2641, September 1975. 4 fig, 9 tab, 11 ref, 1 append. NASA NGL 05-003-404.

Descriptors: *Snow cover, *Remote sensing, *Nevada, *Snow surveys, Snow, Watersheds(Basins), Estimating, Satellites(Artificial), Analysis, Analytical techniques, Data processing, Areal, Distribution, Aerial photography, Census, Moisture content.
Identifiers: *Sierra Mountains(Nev), LANDSAT.

Quantification of the surface area of snow covering watersheds is believed to be a useful parameter in estimating snow water content for inclusion in water runoff prediction equations. The paper documented an operational manual interpretation technique which allows fast and accurate estimates to be made of the areal extent of snow parameter using LANDSAT-1 imagery. The analysis procedures, the statistical results, and the associated costs of this research were presented. One of the possible avenues for lowering the expense of estimating snow areal extent is to develop a library of snow cover conditions, in which the appearance of the snow pack is compared between low altitude photography and satellite LANDSAT imagery, along with other relevant data on an image sample unit basis. Scattered cloud cover over snowpack may present some difficulty to present computer analysis; however, the human has little difficulty distinguishing between the two as they appear on LANDSAT-1 imagery. The inventory methods describes for areal extent of snow estimation show great promise for providing fast, economical, and accurate inventories of snowpack extent. (See also W77-08062) (Humphreys-ISWS)
 W77-08081

SNOW SURVEY FROM SPACE, WITH EMPHASIS ON THE RESULTS OF THE ANALYSIS OF SKYLAB EREP S192 MULTISPECTRAL SCANNER DATA,

Environmental Research and Technology, Inc., Concord, Mass.

J. C. Barnes, and M. D. Smallwood.
 In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p 2643-2659, September 1975. 7 fig, 2 tab, 12 ref. NASA NAS 9-13305.

Descriptors: *Snow surveys, *Remote sensing, *Mapping, *Nevada, *Utah, Data processing, Snow cover, Snow, Snowmelt, Analytical techniques, Satellites(Artificial), Surveys, Reflectance.
Identifiers: *Sierra Mountains, *White Mountains, *Wasatch Mountains, Skylab.

The Skylab EREP S192 Multispectral Scanner data have provided, for the first time, an opportunity to examine the reflectance characteristics of snowcover in several spectral bands extending from the visible into the near-infrared spectral re-

Field 7—RESOURCES DATA

Group 7B—Data Acquisition

gion to about 2 micrometers. The analysis of the S192 imagery and digital tape data from five EREP passes, two from the SL-2 mission and three from the SL-4 mission, indicated a sharp drop in reflectance of snow in the near-infrared, with snow becoming essentially non-reflective in Bands 11 (1.55-1.75 micrometers) and 12 (2.10-2.35 micrometers). The results were in good agreement with the results of laboratory experiments. Two potential applications to snow mapping of measurements in the near-infrared spectral region are possible: (1) the use of a near-infrared band in conjunction with a visible band to distinguish automatically between snow and water droplet clouds; and (2) the use of one or more near-infrared bands to detect areas of melting snow. (See also W77-08062) (Humphreys-ISWS)
W77-08082

FACTORS AFFECTING SNOW ASSESSMENT FROM LANDSAT DATA,

National Environmental Satellite Service, Washington, D.C.

D. F. McGinnis, Jr., M. C. McMillan, and D. R. Wiesnet.

In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p. 2661-2668, September 1975. 3 fig, 31 ref.

Descriptors: *Snow, *Monitoring, *Remote sensing, Snow surveys, Snow cover, Satellites(Artificial), Mapping, Optical properties, Reflectance, Physical properties, Evaluation, Forests, Radiation, Measurement.
Identifiers: LANDSAT.

LANDSAT imagery has been used to map snow extent with great accuracy. Present orbit and sensor characteristics, however, restrict LANDSAT as a snow monitoring satellite. A better understanding of the complexities affecting the radiation reflected by a snowpack will enhance the usefulness of remote sensing of snow from aircraft and satellites. Problems of aspects and slopes may hinder thematic mapping of snow but can be resolved with available solar tables. Detection of snow in forested areas via satellite is a problem still under study. LANDSAT-1 and -2 have revealed the potential for multispectral studies of snow. With minor modifications of sensor and orbit, future spacecraft could become 'SNOWSTAT's'. Raising the detector saturation threshold and extending the upper spectral limit of the MSS will not only improve mapping of snow extent, but also will provide the likelihood of monitoring some aspects of the physical condition of the snowpack. (See also W77-08062) (Humphreys-ISWS)
W77-08083

OPERATIONAL WATER MANAGEMENT APPLICATIONS OF SNOWCOVERED AREA OBSERVATIONS,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

R. Rango, V. V. Salomonson, and J. L. Foster. In: Proceedings of the NASA Earth Resources Survey Symposium, June 1975, Technical Session Presentations, Water Resources, Volume I-D. Report No. NASA TM X-58168. Symposium held June 9-12, 1975, Houston, Texas, p. 2669-2685, September 1975. 6 fig, 5 tab, 7 ref. NOAA/NESS NA-776-74.

Descriptors: *Water management(Applied), *Snow, *Remote sensing, *Wyoming, *Hydrologic aspects, Management, Organizations, Snow cover, Snowmelt, Runoff, Watersheds(Basins), Satellites(Artificial), Analytical techniques, Data processing, Streamflow forecasting, Seasonal.
Identifiers: *Wind River Mountains(Wyo), LANDSAT.

Timely and accurate prediction of snowmelt runoff has great value in the Western United States for organizations or individuals involved in power generation, irrigation, flood control, management of domestic and industrial water supplies, and recreation. An effort has been made to evaluate the utility of satellite snowcover observations for seasonal streamflow prediction. On a representative, large watershed (100,000 to 1,000,000 sq km) it was found, based on six years of data, that meteorological satellite observations of snowcover early in the snowmelt season exhibit a relationship to seasonal runoff, having a statistically significant coefficient of determination of 0.92. Analyses of LANDSAT-1 snowcover observations over the Wind River Mountains of Wyoming revealed that for areas with infrequent cloud cover, the extent of snowcover and its change with time can be monitored on watersheds as small as 10 sq km in areal extent. The change in the snowcover with time as observed from LANDSAT-1 is found to reflect major differences in seasonal runoff from high altitude (mean altitude greater than 3 km) and low altitude (less than 3 km) watersheds. There are quantitative indications that LANDSAT observations over small watersheds could be used in a manner similar to that employed for meteorological satellite observations to related the percent of a basin snowcovered on a given date to seasonal runoff. (See also W77-08062) (Humphreys-ISWS)
W77-08084

7C. Evaluation, Processing and Publication

GENERATION OF MULTIVARIATE SYNTHETIC FLOWS,

Geological Survey, Reston, Va. Water Resources Div.

For primary bibliographic entry see Field 2A.
W77-07610

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, MALHEUR LAKE DRAINAGE BASIN, APPENDIX I-12,

Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07617

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, GOOSE AND SUMMER LAKES DRAINAGE BASIN, APPENDIX I-13,

Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07618

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, KLAMATH DRAINAGE BASIN, APPENDIX I-14,

Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07619

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, ROGUE DRAINAGE BASIN, APPENDIX I-15,

Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07620

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, UMPQUA DRAINAGE BASIN, APPENDIX I-16, Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07621

OREGON'S LONG-RANGE REQUIREMENTS FOR WATER. GENERAL SOIL MAP REPORT WITH IRRIGABLE AREAS, NORTH, MID-, AND SOUTH COAST DRAINAGE BASINS, APPENDIX I-17, AND 18,

Oregon State Univ., Corvallis; and Soil Conservation Service, Washington, D.C.
For primary bibliographic entry see Field 2G.
W77-07622

MUNICIPAL INFORMATION SYSTEMS: EVALUATION OF POLICY RELATED RESEARCH. VOLUME 2. COMPUTER UTILIZATION IN LOCAL GOVERNMENT,

California Univ., Irvine. Urban Information Systems Research Group.
For primary bibliographic entry see Field 6B.
W77-07631

FLOOD PLAIN INFORMATION: THOMPSONS CREEK AND TRIBUTARIES, BRYAN, TEXAS,

Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-07634

FLOOD PLAIN INFORMATION: SAN ANTONIO RIVER, BEXAR COUNTY, TEXAS.

Army Engineer District, Fort Worth, Tex.
For primary bibliographic entry see Field 4A.
W77-07635

SPECIAL FLOOD HAZARD REPORT: JERSEY CREEK, KANSAS CITY, KANSAS.

Army Engineer District, Kansas City, Mo.
For primary bibliographic entry see Field 4A.
W77-07636

FLOOD PLAIN INFORMATION, SOUTH ANNA RIVER, HANOVER COUNTY, VA.

Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-07637

FLOOD PLAIN INFORMATION, NORTH ANNA RIVER, HANOVER COUNTY, VA.

Army Engineer District, Norfolk, Va.
For primary bibliographic entry see Field 4A.
W77-07638

FLOOD PLAIN INFORMATION, CHERRY CREEK-CHERRY CREEK LAKE THROUGH FRANKTOWN, COLORADO.

Army Engineer District, Omaha, Nebr.
For primary bibliographic entry see Field 4A.
W77-07639

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, WARREN COUNTY, PENNSYLVANIA,

Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-07640

FLOOD PLAIN INFORMATION: ALLEGHENY RIVER, VENANGO COUNTY, PENNSYLVANIA,

Army Engineer District, Pittsburgh, Pa.
For primary bibliographic entry see Field 4A.
W77-07641

FLOOD PLAIN INFORMATION: NORTHWEST STREAM GROUP, STOCKTON, CALIFORNIA,
Army Engineer District, Sacramento, Calif.
For primary bibliographic entry see Field 4A.
W77-07642

FLOOD PLAIN INFORMATION: WICHITA RIVER AND TRIBUTARIES, WICHITA FALLS, TEXAS,
Army Engineer District, Tulsa, Okla.
For primary bibliographic entry see Field 4A.
W77-07643

FLOOD PLAIN INFORMATION: IPSWICH RIVER, NORTH READING AND WILMINGTON, MASSACHUSETTS,
Army Engineer District, Waltham, Mass. New England Div.
For primary bibliographic entry see Field 4A.
W77-07644

FLOOD PLAIN INFORMATION: MERRIMACK AND SOUHEGAN RIVERS, LITCHFIELD AND MERRIMACK, NEW HAMPSHIRE,
Army Engineer District, Waltham, Mass.
For primary bibliographic entry see Field 4A.
W77-07645

SOME APPLICATIONS OF STOCHASTIC FLOW GENERATION,
Birmingham Univ. (England).
For primary bibliographic entry see Field 2A.
W77-07647

OBJECTIVE ANALYSIS OF SNOW COVER FIELDS,
Hydrometeorological Service of the USSR, Moscow.
For primary bibliographic entry see Field 2C.
W77-07678

DISSOLVED GAS DATA REPORT, 1975-1976,
Army Engineer District, Portland, Oreg. North Pacific Div.
For primary bibliographic entry see Field 5A.
W77-07718

CHARACTERISTICS OF THE SEVERE RAIN-STORM,
Tokyo Aviation Weather Service (Japan).
For primary bibliographic entry see Field 2B.
W77-07784

WATER QUALITY STATUS AND TRENDS IN MINNESOTA—INDICES FOR WATER SUPPLY AND GROUND WATER POLLUTION,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 5A.
W77-07794

PENN STATE URBAN RUNOFF MODEL—USER'S MANUAL,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W77-07797

A DECISION SUPPORT SYSTEM FOR AREA-WIDE QUALITY PLANNING,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07810

EXTENSIONS AND CORRECTIONS FOR THE CODASYL APPROACH TO DATA BASE MANAGEMENT,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07811

IMPLEMENTATION OF A DECISION SUPPORT FOR REGIONAL WATER QUALITY PLANNING,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07812

INFORMATION TRANSFERRAL WITHIN A DISTRIBUTED DATA BASE VIA A GENERALIZED MAPPING LANGUAGE,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07813

AIDING DECISION MAKERS WITH A GENERALIZED DATA BASE MANAGEMENT SYSTEM: AN APPLICATION TO INVENTORY MANAGEMENT,
Krannert Graduate School of Management, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07814

OBSERVATIONS ON A GENERALIZED INTELLIGENT QUERY PROCESSOR FOR DECISION SUPPORT,
Krannert Graduate School of Industrial Administration, Lafayette, Ind.
For primary bibliographic entry see Field 6A.
W77-07849

MATHEMATICAL PROGRAMMING WITHIN THE CONTEXT OF A GENERALIZED DATA BASE MANAGEMENT SYSTEM,
Purdue Univ., Lafayette, Ind. Water Resources Research Center.
For primary bibliographic entry see Field 6A.
W77-07850

OPTIMIZATION OF WATER USE FOR IRRIGATION,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W77-07851

STUDY OF THE RIO GRANDE, BOLIVIA HIGHLIGHTS SOME BASIC QUESTIONS ABOUT SIMULATION,
Hydrocomp, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 2A.
W77-07945

THREE CASE STUDIES ON THE APPLICATION OF THE STORM WATER MANAGEMENT MODEL,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 5B.
W77-07955

HYDROLOGIC OPTICS. VOLUME I. INTRODUCTION,
National Oceanic and Atmospheric Administration, Honolulu, Hawaii. Joint Tsunami Research Effort.
For primary bibliographic entry see Field 1A.
W77-07956

MATHEMATICAL MODELING OF REGIONAL WATER-SUPPLY SYSTEMS IN YUGOSLAVIA,
Energoprojekt, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 4A.
W77-08033

STATISTICAL FORECASTING OF SNOW AVALANCHES, SAN JUAN MOUNTAINS, SOUTHERN COLORADO, U.S.A.,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W77-08055

PRESENT AND PAST GLACIATION THRESHOLD IN THE CASCADE RANGE, WASHINGTON, U.S.A.: TOPOGRAPHIC AND CLIMATIC CONTROLS, AND PALEOCLIMATIC IMPLICATIONS,
Washington Univ., Seattle. Dept. of Geological Sciences; and Washington Univ., Seattle. Quaternary Research Center.
For primary bibliographic entry see Field 2C.
W77-08056

8. ENGINEERING WORKS

8A. Structures

IMPROVEMENT AND EXPANSION OF THE DRAINAGE SYSTEM OF HAMBURG,
Abwassertechnische Vereinigung e. V., Bonn (West Germany).
For primary bibliographic entry see Field 5D.
W77-07890

FLOATING BREAKWATER,
Bridgestone Tire Co., Ltd., Tokyo (Japan). (Assignee).
S. Tazaki, and Y. Ishida.
U.S. Patent No 3,991,576, 16 p, 16 fig, 5 ref; Official Gazette of the United States Patent Office, Vol 952, no 3, p 978, November 16, 1976.

Descriptors: *Patents, *Engineering structures, *Breakwaters, Floating, Shore protection, Waves(Water), Wavelengths.

A floating breakwater is provided having an excellent wave breaking efficiency which has a simple structure, can be provided at a low cost, and has a ratio of the height of wave passed through the floating body to the height of wave before passing the floating body of less than 0.5 in a length of the floating body of less than 1/2 of the wave length. It was found that the wave breaking efficiency is influenced by phase difference, reflection, friction, whirlpool action of the wave, and the like. When a floating breakwater is set on the water surface, if the floating body makes the same motion as that of the wave, the wave breaking efficiency is poor. In order to increase the wave breaking efficiency due to the phase difference the floating body is fixed at a constant position near the water level as far as possible to control the upward and downward motion against the water level effectively. The wave breaking efficiency due to the reflection and friction is enhanced by providing a projected body on the upper side of the floating body. A weighting material is added for increasing weight and specific gravity of the floating body. (Sinha-OEIS) W77-08009

TIDEWATER POWER SYSTEM,
For primary bibliographic entry see Field 8C.
W77-08022

Field 8—ENGINEERING WORKS

Group 8B—Hydraulics

8B. Hydraulics

MANUEL TECHNIQUE DU VILLAGE, (VILLAGE TECHNOLOGY HANDBOOK), (VOLS. 1 AND 2).

Volunteers in Technical Assistance, Mt. Rainier, Md.

For primary bibliographic entry see Field 3F.
W77-07628

STOCHASTIC ANALYSIS OF VELOCITY FLUCTUATIONS IN A NATURAL STREAM CHANNEL.

Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.

For primary bibliographic entry see Field 2E.
W77-07648

DETERMINATION OF THE DEGREE OF PROTECTION OFFERED BY FLOOD CONTROL SYSTEMS ON THE BASIS OF DISTRIBUTION FUNCTIONS.

Water Resources Centre, Budapest (Hungary).
I. Bogardi.

In: *Mathematical Models in Hydrology*, Volume 1; Proceedings of the Warsaw Symposium, July 1971: International Association of Hydrological Sciences Publication No. 100, p 246-252, 1974. 4 fig, 3 ref.

Descriptors: *Flood protection, *Flood control, *Levees, *Model studies, Mathematical models, Flood plains, Floodproofing, Rivers, Streams, Floods, Probability, Statistical models, Earthworks, Structures, Hydraulic structures, Foreign research.

The degree of protection offered by flood levee systems varies at random along the length of the levee owing to the gradual progression of construction work, changing soil conditions, and other factors. The degree of protection was determined by statistical sampling of individual cross sections, with regard also to the cases of possible failure. Thus, one random variable is the degree of protection along the levee. At the same time, there is a probability of flood occurrence associated with every value of the degree of protection. The efficiency, i.e., the load bearing capacity of the flood protection system, can be determined from the probability distribution function influenced by the two independent variables. The method can be applied mainly to streams having flat slopes and broad flood plains, where in the case of floods the degree of protection at the weak points of the system can be enhanced by protection work. This work can be accurately defined as the area under the distribution function of the degree of protection. This is the procedure that the actual state of the degree of protection of the various systems—taken as starting data for the optimum development of flood protection—is determined. (See also W77-06708) (Sims-ISWS)
W77-07673

EMPTINESS OF A FINITE DAM—TIME DEPENDENT THEORY.

Indian Inst. of Tech., Madras. Dept. of Mathematics.
S. K. Srinivasan.

In: *Mathematical Models in Hydrology*, Proceedings of the Warsaw Symposium, Poland. Volume 1, July 1971. IAHS/Unesco, Paris, France, 1974, p 395-400. 10 ref.

Descriptors: *Dams, *Stochastic processes, Water levels, Probability, Equations, Mathematical models, Systems analysis.

Identifiers: *Finite dams, First emptiness, Laplace transform, Linear equations, Poisson inputs, Water releases.

A stochastic model of a finite dam governed by Poisson inputs is considered. Corresponding to

unit release rate a renewal equation is set up for the probability frequency function governing the water level in the first wet period. The resulting equation is solved by the Laplace transform technique and an explicit expression for the Laplace transform of the probability frequency function governing the time to first emptiness is obtained. The probability frequency function governing the water level of the dam at any arbitrary time is also deduced. (See also W77-06708) (Bell-Cornell)
W77-07683

E.L.C. WATER DEVELOPMENT PROJECT, BETUL (M.P.) INDIA: FIFTH ANNUAL REPORT, 1975-1976.

Evangelical Lutheran Church, Betul (India). Water Development Project.
(1976). 16 fig, 13 tab, 4 ref, 7 append.

Descriptors: Aquifers, *Drilling, Drilling equipment, *Pumping, *Water wells, Asia, Groundwater, *Pumps.

Identifiers: E.L.C. Water Development Project (India), *Madhya Pradesh (India).

The Evangelical Lutheran Church (E.L.C.) Water Development Project is currently based in Betul, Madhya Pradesh, India, and serves the neighboring Chhindwara and Seoni districts as well. Underlying terrain in these areas is predominantly basalt with a fair amount of crystallines, Gondwana sandstones, and shales. 90 percent of the 36-50 inches of annual rainfall occurs during the June-September monsoon season. The Project is organized as three basic departments: the Groundwater Investigation Department (Groundwater Investigation Team, Test Pumping Unit, Pump Installation and Repair Unit, and Laboratory), the Drilling Department (Tubewell Drilling and Extension Drilling), and the Base Facilities (Workshop and Stores). Since 1971, drilling has been done with two Halco 625 down-the-hole hammer rigs, backed up by appropriate support equipment. Hard use and age have caused a great deal of downtime due to repairs. The addition of a new Chicago Pneumatic T-7000-3 rotary rig plus support equipment is expected to ease the drilling burden. To date, 482 successful tubewells have been drilled by the Project for a variety of purposes. Major studies of bacterial quality of water sources and utilization of tubewell installations in Betul District were also undertaken in 1976. (Eberle-NWWA)
W77-07696

SIMULATION OF IMPOUNDMENT TERRACE HYDRAULICS.

Auburn Univ., Ala. Dept. of Agricultural Engineering.

E. W. Rochester, and C. D. Busch.

Transactions of the American Society of Agricultural Engineers, Vol. 20, No. 1, p 76-78, 84, January-February 1977. 5 fig, 8 ref.

Descriptors: *Terracing, *Impoundments, *Model studies, Mathematical models, Inflow, Discharge (Water), Depth, Water levels, Computer models, Pipes, Pipe flow, Drainage, Hydraulics, Agriculture, Simulation analysis.

A digital simulation predicts flow conditions associated with a series of two impoundment terraces. The simulation routes inflowing water through the impoundments and associated discharge pipes. Results of the simulation include depths of the water in each impoundment, flow rates through each discharge pipe, and hydraulic head at the junction of the pipes. (Sims-ISWS)
W77-07767

ASPECTS OF BANKFULL GEOMETRY IN A DISTRIBUTARY SYSTEM OF EASTERN AUSTRALIA.

Macquarie Univ., Ryde (Australia). School of Earth Sciences.

For primary bibliographic entry see Field 2E.
W77-07782

CHANNELIZATION: ENVIRONMENTAL, GEOMORPHIC, AND ENGINEERING ASPECTS.

North Carolina Univ. at Charlotte. Dept. of Geography and Earth Science.
E. A. Keller.

In: *Environmental Geology*, Chapter 7, published by John Wiley, (New York), 1976, p. 115-140. OWRT B-089-NC(3), 14-34-0001-6103.

Descriptors: *Channel morphology, *Channel improvement, *Geomorphology, Drainage engineering, Bank stability, Stream improvement, Stream stabilization, Channel erosion, Meanders. Identifiers: *Channel restoration, *Fluvial processes, *Channelization, Stream alignment, Fluvial geomorphology.

Channelization is a controversial issue, and, although more environmental aspects are being considered today than ever before, the pressure to modify channels will increase in the future. Therefore, it is important to discover ways to modify channels that will minimize environmental degradation and maximize the overall return to man. Two types of channel work are currently being done: (1) emergency work on streams, following catastrophic events, that too often is poorly planned and executed, and (2) channelization that is planned but may or may not be properly engineered and include consideration of environmental impact. Several aspects of fluvial geomorphology and hydrology that are now or may eventually be helpful in designing more natural channels are (1) the concept that streams are open systems in which channel form and process evolve in harmony, (2) utilization of the convergent-divergent criterion, (3) identification of geomorphic thresholds for stream channels, and (4) recognition of the complex relationships between deposition, erosion, and sediment concentration. Engineering trends in channelization include constructing structures to provide diversity of aquatic habitat, the continuing use of river-training procedures, the construction of more natural appearing channels, and channel restoration of streams degraded by adverse land use. The state of the art of channelization still suffers from lack of understanding concerning the behavior of alluvial streams; therefore, it is recommended that future necessary channelization be confined to the shortest possible length of channel and provide the least amount of artificial control necessary to meet the desired objective of the project. (Stewart-NC State)
W77-07809

HOW TO DETERMINE WASTE WATER FLOW.

For primary bibliographic entry see Field 5F.
W77-07881

THE CONCEPTION, DESIGN, AND CONSTRUCTION OF METROPOLITAN TORONTO MID-TORONTO SEWER.

Maclaren (James F.) Ltd., Willowdale (Ontario).
L. N. Hogarth.

Canadian Journal of Civil Engineering, Vol. 4, No. 1, p 47-56, March, 1977. 3 fig, 3 ref.

Descriptors: *Sewers, *Construction, *Design criteria, *Interceptor sewers, Tunneling, Automatic controls, Engineering structures, Flow, Hydraulic design, Operation and maintenance, Performance, Construction techniques, Construction materials, Waste water treatment. Identifiers: Toronto (Canada).

Various factors of the planning, design, and construction of an intercepting sewer in Toronto, Canada, were discussed. Considerations of flows in the Toronto area and hydraulics of the area were prime factors of the system's design. Ad-

vantages of the deep sewer design used include the dewatering of existing intercepting sewers for inspection, repair, or restoration without raw sewage discharge to the lakefront. Surplus flows of present sewers will be discharged to the new interceptor sewer. Pumping station and trunk sewer connections will also allow continued maintenance of the present low and high level sewers and their pumping station, as well as that of the new system, without sewage loss to the lake. Dynamic operation measures flows in various sewers and, manually or automatically, diverts flow from sewer to sewer by the regulation of gates. This utilizes full sewer capacity while reducing overflows. Backflows into trunk sewers should be avoided and flow tributary to the interceptor sewer must be measured to achieve flow routing. Air trapped in sewage during the fall to the interceptor sewer is vented by a structure in a spur tunnel horizontal to the main interceptor sewer. Access shafts for maintenance and inspection of the interceptor sewer are located at 305-1219 meter intervals. A level sensing bubble is located at each shaft and hydraulic gradients can be accurately measured at these points. The shafts are located at points where the 150 centimeter diameter cross connections between high and low level interceptors meet the new interceptor systems. Construction, maintenance and operation data are being collected. (Collins-FIRL)
W77-07888

MATHEMATICAL MODELING OF REGIONAL WATER-SUPPLY SYSTEMS IN YUGOSLAVIA.
Energoprojekt, Belgrade (Yugoslavia).
For primary bibliographic entry see Field 4A.
W77-08033

8C. Hydraulic Machinery

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES, VOLUME I, FINANCING PACIFIC NORTHWEST ELECTRIC GENERATION.
Kell, Alterman and Runstein, Portland, Oreg.
L. Jourlman, R. M. Kell, R. C. Jackson, and J. Kell.
Completion Report, 1976. 193p, 102 ref.

Descriptors: *Pacific Northwest U.S., *Electric power production, *Electric power costs, *Capital costs, *Financing, Regulation, Legal aspects, *Permits, *Legislation, Administrative agencies, Federal government, State government, Thermal power, Nuclear powerplants, Hydroelectric plants, Pollution abatement, Coordination, *Electric power demand, *Water law.

Volume I of the study investigates the changes in financing structure, administrative licensing and environmental law which are necessary to expedite future electric power generation in the Pacific Northwest. The present roles of public and private utilities, direct service industries and the federal government are reviewed. Existing areas of joint coordination, planning and financing between these groups are described. The study discusses the financing of the existing electric power facilities in the Northwest. An estimate of needed future construction capital is made and alternative methods for raising this capital, at the lowest possible cost to the consumer are proposed. The study outlines a new role for the federal government in financing new generation. (See also W77-07602)
W77-07601

LAWS NEEDED TO EXPEDITE ELECTRIC GENERATION SCHEDULES FOR THE PACIFIC NORTHWEST: FINANCING, ENVIRONMENTAL LAWS AND LICENSING

PROCEDURES, VOLUME II, ENVIRONMENTAL LAWS AND SITING AND LICENSING PROCEDURES.
Kell, Alterman and Runstein, Portland, Oreg.
For primary bibliographic entry see Field 6E.
W77-07602

NWWA GROUND WATER HEAT PUMP RESEARCH IMPERATIVES.
Water Well Journal, Vol. 31, No. 4, p 60-61, April, 1977.

Descriptors: *Energy, Research facilities, Heating, Cooling, *Groundwater recharge, Thermal properties, *Pumps.
Identifiers: *Groundwater heat pumps.

Considerable research is necessary before use of ground water heat pumps can become a vital part of America's energy resource system. As federal monies become available to help support its work in heat pump research, the National Water Well Association Research Facility will concentrate on two specific areas: (1) Thermodynamic and Qualitative Effects on the Ground Water Environment, an (2) Mechanical System Development for Heat Extraction and Discharge. Essential studies under the first category would include conservation of heat energy in small domestic subdivisions (e.g., how will heat from injected water move in aquifers, what is the potential for permanent temperature alteration in local ground water systems, etc.), discharge of water used in a heat pump without concern for heat energy conservation and the consequences thereof, and legal aspects of heat pump effluent disposal. Under the second category, systems such as dual reversing wells, single location doublet wells, and 'in situ heat extraction' deserve serious investigation. Finally, NWWA desires to perform cooperative research on water-to-air heat pump machinery currently manufactured for market to determine performance under varying water temperature, water quality, and flow conditions. (Eberle-NWWA)
W77-07692

RESEARCH FOUNDATION UTILIZES GROUND WATER HEAT PUMPS.
National Water Well Association, Worthington, Ohio.
H. W. Heiss.
Water Well Journal, Vol. 31, No. 4, p 58-59, April, 1977. 1 fig.

Descriptors: *Energy, Heating, *Cooling, *Groundwater, Ohio, Iron bacteria, Fouling, *Pumps.
Identifiers: *Groundwater heat pumps, Columbus(Ohio).

Batelle Memorial Institute installed a ground water heat pump system in 1957 as an alternative to coal and oil heating. The systems consists of two separate heat pumps used to heat and cool four buildings of Batelle's Columbus, Ohio, complex, a total area of 317,000 square feet. Batelle Facilities Manager Bill Welker and Ralph Kramer of Kramer, Comer and Pass designed the system utilizing Trane centrifugal compressors, evaporators, condensers, and coils. Fed by a field of six wells providing water at a constant 55 degrees Fahrenheit, Batelle heat pumps demonstrated a coefficient of performance (BTU output/input) of 4.4 for cooling and 5.4 for heating processes. Only a few problems have occurred in the 19 years of the system's operation: iron bacteria fouling small tubes and orifices and corrosion of coils were both corrected with additives to the well water, while breakdowns due to component vibration under low load conditions is now avoided by the limited use of a small oil-fired backup heating system during such periods. All major original equipment is still operating today. (Eberle-NWWA)
W77-07693

GROUND WATER ENERGY AND THE GROUND WATER HEAT PUMP.
National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 8C.
W77-07694

GROUND WATER ENERGY AND THE GROUND WATER HEAT PUMP.
National Water Well Association, Worthington, Ohio.
T. E. Gass, and J. H. Lehr.
Water Well Journal, Vol. 31, No. 4, p 42-47, April, 1977. 4 fig.

Descriptors: *Energy, *Heating, *Cooling, *Groundwater, Groundwater recharge, Specific heat, Thermal properties, *Pumps.
Identifiers: *Groundwater heat pumps.

A device called the heat pump can be used to convert stored energy in ground water to usable energy for heating and cooling. Because water has a very high Specific Heat, it has enormous potential to store and absorb heat energy. Ground water heat pump systems make use of gaseous refrigerant heat exchangers to either extract from or sink heat into an incoming water supply and derive a BTU output several times that of the equivalent kilowatt input. Ground water temperature in the U.S. ranges between 75 degrees in the south and 40 degrees in the north, varies little throughout the year, and is thus a more stable and efficient basis than surface water or air. Recent advances in equipment design and increases in the cost of conventional energy sources make ground water heat pumps economically practical for the future. Potential environmental consequences must, of course, be carefully examined, but the prognosis for the application of heat pumps by themselves and as adjuncts to other types of heating systems is indeed favorable. (Eberle-NWWA)
W77-07694

E.L.C. WATER DEVELOPMENT PROJECT, BETUL (M.P.) INDIA: FIFTH ANNUAL REPORT, 1975-1976.
Evangelical Lutheran Church, Betul (India).
Water Development Project.
For primary bibliographic entry see Field 8B.
W77-07696

PUMPING SYSTEMS: PART II.
National Water Well Association, Worthington, Ohio.
R. B. McDannald.
Water Well Journal, Vol. 31, No. 4, p 38-39, April, 1977.

Descriptors: *Pumps, *Electric wiring, Electric wires, Plastic pipes, Valves, Wells.
Identifiers: *Submersible pumps, *Pitless adapters, Pressure tanks.

Keeping pumping systems simple and trouble-free requires quality workmanship and reliable materials, as noted in the following suggestions. Plastic insulated electric wire is preferred to neoprene insulation for greater resistance to cutting and scuffing, and for ease of stripping. Do not overlook ease of future well cleanout when selecting a pitless adapter; use a holesaw to make a hole in the casing for installation of the adapter instead of a cutting torch unless a real expert is available. Virgin polyethylene pipe is suggested for use between the pitless adapter and the basement wall to the pressure tank as it makes for a better visual impression. All systems should have a check valve at the pump discharge; a second check valve before the pressure tank tee or fittings pack acts as a safeguard and can reduce service calls. To provide the customer with uniform water flow and avoid pressure loss and waterlogging, 3/4 inch feeder plumbing lines in combination with a captivated air type tank and either gate or ball type supply valves

Field 8—ENGINEERING WORKS

Group 8C—Hydraulic Machinery

are all recommended to complete the system. (See also W77-06856) (Eberle-NWWA) W77-07704

ELECTRONIC ISOLATION SIMULATOR FOR HYDRAULIC TURBINE GOVERNOR ALINEMENT

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
L. E. Eilts.
Report REC-ERC-77-2, January 1977. 9 p, 8 fig, append.

Descriptors: *Governors, Regulation, Electronic equipment, Control systems, Analog computers, Dynamics, Hydroelectric powerplants, *Testing procedures.
Identifiers: *Isolation simulator, *Governor alignment testing, Servomechanisms.

This report describes the theory of governor alignment by the technique of simulated isolation. The design, assembly, circuit configuration, and external connections of an electronic isolation simulator for governor alignment testing are presented. Procedures for setting up and using the isolation simulator are outlined and typical governor responses obtained during simulated isolation tests are illustrated. The calculations and potentiometer setting determinations, prerequisite to this type of testing, are exemplified. (Bur Reclam) W77-07804

TIDEWATER POWER SYSTEM

S. V. Dickman.
U.S. Patent No. 3,993,913, 13 p, 20 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 952, no 4, p 1833, November 23, 1976.

Descriptors: *Patents, *Tidal energy, *Tidal powerplants, *Engineering structures, Dams, Dam design, Flow, Water level fluctuations.
Identifiers: Water wheels.

A system for extracting power from the tides includes a dam constructed in a body of water subject to tidal flow for separating the body of water from a tidal basin between the dam and the shoreline. Water wheel assemblies are mounted on the dam and include mounting saddles for rotation about a horizontal axis at a level about the high tide level and with the bottom of the water wheel at the low tide level. Each saddle includes a pair of vertical wall members, between which the water wheel is mounted for rotation, and a horizontal wall portion below the water wheel provided with a concave recess receiving the water wheel. The saddle is so constructed that the water flowing from the body of water to the tidal reservoir and vice versa will flow through the water wheels. In order to control this flow, a brake is provided to block rotation of the water wheels at the discretion of an operator. The dam is constructed from spaced vertical I-beams and horizontal slabs which extend between successive I-beams. A saddle extension mounts the saddle on the dam by fitting vertical arm members between the flanges of successive I-beams. The water wheel includes radially extending paddles and may have its ends closed by end walls; vent apertures are provided, either in the paddles adjacent the shaft or in the end walls adjacent the shaft. (Sinha-OEIS) W77-08022

APPARATUS FOR POWER GENERATION IN DEEP SEAWATER

Cooper Union Research Foundation, Inc., New York. (Assignee).
S. E. Molnar.
U.S. Patent No. 3,994,134, 6 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 952, no 5, p 1939, November 30, 1976.

Descriptors: *Patents, *Engineering structures, *Energy conversion, Sea water, Underwater, Electric power production, Equipment.

The apparatus consists of: pumping equipment within an angular border frame; a locomotion equipment with motor and counterbalancing system; a prime mover and a power generator. The assemblage is placed on the seabottom; and the pumping and locomotion equipment are placed in vertical position. Above the anchored base the frame encompasses a reciprocating water receiving receptacle and a congruent plunger. The receptacle with its water receiving chamber and the plunger made of pumping equipment that slides with its outer ends along the sidewalls of the angular frame, carries out diverging-converging as well as upward and downward movements, and results in reciprocal and at the same time telescopic operation. While moving divergently upward and apart, the receptacle and plunger create an empty space in the interior of the receptacle. Arriving at its upper filling position, the empty receptacle chamber is tightly connected with the prime mover, through opened valves. Forced to act by the admitted powerful seawater, the prime mover accomplishes its performance so that when the receptacle is filled with water, during upward movement the receptacle chamber is filled with air from the sea-surface through the connected plunger pocket avoiding a vacuum. Moving convergently downward, the plunger expels the water from the receptacle chamber into the sea. Valves act accordingly. The cyclical movements repeat. Complementarily employed and working twin pumping equipment or accumulated electric energy secure continuous operation of the apparatus. (Sinha-OEIS) W77-08023

MECHANISM FOR TAPPING THE SURF ENERGY

L. Tah-sun.
U.S. Patent No. 3,994,629, 5 p, 3 fig, 3 ref; Official Gazette of the United States Patent Office, Vol 952, no 5, p 2105, November 30, 1976.

Descriptors: *Patents, *Surf, *Engineering structures, *Beaches, Coasts, Waves(Water), Ocean waves, Energy, *Energy conversion.

The primary object of the invention is to provide a means to tap the energy of the surf and to store the energy in a huge energy storage tank in the form of potential energy for later usage in driving various machinery, including a generator. The uniformity of revolution is important in any case, and of particular importance in case the machinery driven is a generator, as this means the uniformity of the frequency of the output electricity. The mechanism includes a gravitational bucket with a rack on the outside. The rack engages a gear which drives a reciprocating water pump. The pump transports water to a tank for use later as a source of steady controllable energy. (Sinha-OEIS) W77-08026

METHOD AND APPARATUS FOR OBTAINING ELECTRICAL POWER FROM SEA WATER

Carnegie-Mellon Univ., Pittsburgh, Pa. (Assignee).
C. Zener, and J. G. Fetkovich.
U.S. Patent No. 3,995,160, 5 p, 2 fig, 2 ref; Official Gazette of the United States Patent Office, Vol 952, no 5, p 2263, November 30, 1976.

Descriptors: *Patents, Thermal properties, *Oceans, *Sea water, *Thermal power, *Energy transfer, Enthalpy, Thermodynamics, Electric power production, Thermal powerplants.
Identifiers: Foam, Ocean water foam.

This invention relates to a method and apparatus for producing such power from the enthalpy released from a rising foam generated from the ocean water. In operation the colder deep ocean water is drawn through a conduit into a condenser at approximately sea level. Warmer surface water is drawn into the dome through inlet ports and transported to foam generating means. The higher

temperature surface water and the lower temperature deep ocean water are now in proximity of each other in a closed environment. The presence of higher and lower temperature water in the closed environment results in pressure gradients within the dome and reduces the pressure of the warmer water to a value below its saturation vapor pressure. This decrease causes the warmer water to evaporate. A foam inducing medium is introduced into the warmer water and causes the formation of a foam. As a result of the pressure gradients, the foam flows toward the colder water zones of the dome and comes into contact with the foam separator means where the liquid phase and vapor phase are separated. The liquid phase is then transported by conduit means to the turbine and the vapor phase is transported to the condenser and both are pumped through exhaust ports to the ocean. Electricity is produced by using the various physical, thermodynamic and mechanical properties of ocean water foam. (Sinha-OEIS) W77-08032

OPTIMAL ENGINEERING DESIGN UNDER UNCERTAINTY BY GEOMETRIC PROGRAMMING

Unternehmensberatung Schumann G.m.b.H., Cologne (West Germany).
R. D. Wiebking.
Management Science, Vol. 23, No. 6, p 644-651, February 1977. 1 tab, 15 ref, append.

Descriptors: *Design, *Powerplants, *Cooling water, *Optimization, *Economic efficiency, *Stochastic processes, Condensers, Steam turbines, Operating costs, Annual, Probability, Equations, Mathematical models, Systems analysis, *Risks.
Identifiers: *Geometric programming, *Cost minimization, Objective function, Cost function, Statistical error propagation method.

The production of electrical power in a steam powerplant requires that amounts of waste heat from the generating process be rejected to a heat sink. A conventional 'once-through' condensing system is considered in which the turbine exhaust steam is condensed in a surface-type condenser and the heat of condensation is rejected to circulating water taken from a natural body of water. Presented is an application of stochastic (posynomial) geometric programming to the optimal engineering design problem of minimizing the annual costs. A theory developed by Avriel and Wilde for calculating and bounding the expected value of the objective function is summarized. A method known as the statistical error propagation method is used to calculate approximate confidence intervals for the cost function. Stochastic geometric programming is applied to the design problem in the presence of uncertainty (e.g., fuel costs can vary with market conditions). It is shown how the design engineer can extract a considerable amount of information from the solution of merely one small optimization problem. If tighter bounds on the expected cost value are desired, knowledge of discrete probability distributions for the individual random parameters is required and additional optimization problems must be solved. (Bell-Cornell) W77-08040

8D. Soil Mechanics

A VALLEY CROSSING IN PLEISTOCENE DEPOSITS, Saskatchewan Univ. Saskatoon. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8E. W77-07778

8E. Rock Mechanics and Geology

A VALLEY CROSSING IN PLEISTOCENE DEPOSITS,

Saskatchewan Univ. Saskatoon. Dept. of Civil Engineering.
E. K. Sauer.
Engineering Geology, Vol. 11, No. 1, p 1-21, March 1977. 15 fig, 1 tab, 13 ref.

Descriptors: *Valleys, *Canada, *Engineering structures, *Dam foundations, Bridges, Highways, Boulders, Geologic investigations, Rotary drilling, Excavation, Melt water, Channels.
Identifiers: *Saskatchewan, *Arm River(Canada), *Valley crossings, Proglacial channels, Meltwater erosion, Pleistocene deposits, Geophysical logging.

Proglacial meltwater channels are of considerable importance in geotechnical engineering in Southern Saskatchewan. Dams, roads, bridges, and urban development are major projects involving these channels. The Arm River crossing illustrates the types of problems that can occur in highways constructed across these channels, including instability, groundwater control, and excavation through a boulder pavement. The report demonstrated how these problems can be resolved by establishing the geology of the sites and by designing to preclude geotechnical problems. The investigation involved rotary drilling, geophysical logging, installation of piezometers, and engineering analysis. (Lee-ISWS)
W77-07778

MECHANICAL AND HYDRAULIC PROPERTIES OF ROCKS RELATED TO INDUCED SEISMICITY.

California Univ., Berkeley. Lawrence Berkeley Lab.; and California Univ., Berkeley. Dept. of Civil Engineering.
P. A. Witherspoon, and J. E. Gale.
Engineering Geology, Vol. 11, No. 1, p 23-55, March 1977. 21 fig, 96 ref.

Descriptors: *Rock properties, *Mechanical properties, *Hydraulic properties, *Model studies, Seismic studies, Stability, Fractures(Geologic), Failure(Mechanics), Earthquakes, Deformation, Mathematical models, Porosity, Numerical analysis.
Identifiers: *Continuum models, *Discrete models, Two-porosity models, Parallel-plate conduits, Stick slip.

The mechanical and hydraulic properties of fractured rocks were considered in connection with the role they play in induced seismicity. In many cases, the mechanical properties of fractures determine the stability of a rock mass. Stick slip has been proposed as the failure mechanism in earthquake events. In considering the hydraulic properties, it has been customary to treat a fracture as a parallel-plate conduit, and a number of mathematical models of fracture systems have adopted this approach. In most of this work, the assumption has been made that the fractures are rigid. However, it is clear from a review of the mechanical and hydraulic properties that not only are fractures easily deformed, but also they constitute the main flow paths in many rock masses. Two approaches were used in attempting to numerically model such behavior: (1) continuum models, and (2) discrete models. The continuum approach only needs information as to average values of fracture spacing and material properties. The discrete approach, on the other hand, requires details of the fracture geometry and material properties of both fractures and rock matrix. The possibility of extending these methods to deeper fracture systems needs more investigation. (Visocky-ISWS)
W77-07779

8F. Concrete

CEMENTING OIL AND GAS WELLS, INCLUDING CASING HANDLING PROCEDURES: PART 1.

Completion Technology Co., Houston, Tex.
G. O. Suman, Jr., and R. C. Ellis.
World Oil, Vol. 184, No. 4, p 43-51, March, 1977. 13 fig, 2 tab, 33 ref.

Descriptors: *Well casing, *Cement grouting, Welded joints, Drilling, Drilling fluids, Joints(Connections), Oil wells.
Identifiers: Zone isolation, Cement-casing bond, Cement-foundation bond, Mud wetting, Well casing performance, Well casing failure.

Since an improper cementing job can lead to almost any well completion or production problem imaginable, close attention to the cementing process should be the drilling operator's vital concern. Cement used in primary cementing is normally designed to support axial load of the casing string, for zone isolation, to protect casing from damage or failure, and to support the borehole during the productive interval. The success of the cement-casing and cement-formation bonds, however, depends upon the type of casing surface, type of fluid wetting (or its absence), presence or absence of a mud cake against the borehole wall, and various other downhole conditions. Salt flow and fault slippage place stresses on casing which must be dealt with using specialized cementing techniques, or in the case of fault, possible omission of cementing altogether. Precautions taken while drilling and during casing movement can help prevent the casing sticking at critical phases of well completion. Additional precautions with respect to drilling speed, use of plugs, and in the joining of pipe are essential in minimizing casing joint loss. (Eberle-NWWA)
W77-07697

OPEN-HOLE POROSITY LOGS CAN BE USED IN CASSED HOLES.

Dresser Atlas Co., Houston, Tex.
For primary bibliographic entry see Field 8G.
W77-07698

SLURRY AND PUMPING GUIDELINES SMOOTH CASING-CEMENTING JOBS.

Western Co., Corpus Christi, Tex.
C. Clement, and P. Parker.
Oil and Gas Journal, Vol. 75, No. 15, p 54-59, April 11, 1977. 3 fig, 5 tab.

Descriptors: *Well casings, *Cement grouting, *Slurries, *Drilling fluids, Drilling, *Oil wells.
Identifiers: Circulation loss, Mud additives, Cement additives.

Cementing well casing may be achieved in a number of ways, but a few basic principles prevail. There are six types of casing cemented in oil and gas wells: (1) Conductor casing, used at the top of the hole to return drilling fluid to the pit and prevent cave-in; (2) Surface casing, which prevents hole caving and protects surface waters; (3) Intermediate casing, which seals off weak zones; (4) Production casing, which isolates production zones and houses equipment; (5) Liner, sometimes used in lieu of production casing; and (6) Tieback casing, connecting the liner to the surface. As drilling proceeds into deeper and deeper zones, more steps are involved in the cementing process. Spacer and filler cements may be necessary in addition to completion cements. More complicated combinations of plugs, guide shoes, float shoes, and float collars are employed in feeding cement slurries to intermediate and production casings than are required for the conductor and surface casing strings. Specifications for slurry mixtures for different types of casing and detailed procedures for placing the cement are given. (Eberle-NWWA)
W77-07699

ELIMINATING IRON-BEARING WATER FROM WELL NO. 7,

Ottawa City Engineers Office, Ill.

For primary bibliographic entry see Field 5G.

W77-07702

CONCRETE-POLYMER MATERIALS—FINAL REPORT (USBR-BNL-AEC-OSW COOPERATIVE PROGRAM).

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
G. W. DePuy, J. T. Dikeo, W. T. Lockman, and M. C. Redmond.
Report REC-ERC-76-10, August 1976. 79 p.

Descriptors: *Concrete technology, Concrete testing, Research and development, Materials engineering, Construction materials, Composite materials, *Polymers, Monomers, *Concretes, Durability.
Identifiers: *Concrete-polymer materials, *Polymer-impregnated concrete, Polymer-cement concrete, Composite materials.

The Bureau of Reclamation and Brookhaven National Laboratory conducted a joint research program on development of concrete-polymer materials under the sponsorship of the then U.S. Atomic Energy Commission, the then Office of Saline Water, and the Bureau of Reclamation. The program began in 1967 and continued to June 1973. Five topical reports have been published on the work performed through June 1972. Test results presented were conducted at the Bureau during the final year of the cooperative program, and include: (1) work on monomer and composites surveys, (2) process technology development for PIC (polymer-impregnated concrete), (3) test results on PIC at ambient and elevated temperatures, (4) examination of PIC after exposure to brine at elevated temperatures, (5) nondestructive testing of PIC, and (6) a brief summary of applications development. The purpose of this report is to record final data from the testing program. Detailed analyses of these data are not included. (Bur Reclam)
W77-07803

TELESCOPING FORM SYSTEM SPEEDS SEWER CONCRETING.

Water and Sewage Works, Vol. 124, No. 3, p 68, March, 1977.

Descriptors: *Sewers, *Concrete construction, *Concrete technology, *Formwork(Construction), Concrete placing, Concrete structures, Equipment, Engineering structures, Tunnel construction, Interceptor sewers, Ohio.
Identifiers: Cleveland(OH).

A telescoping two-section concrete form system was used for sewer construction in Cleveland, Ohio. Concrete is poured around a steel form to make a 9-foot diameter tube. While the concrete sets behind one of the two-piece sections, the other is stripped from a completed sewer wall portion, threaded through the first set of forms, and placed for the next pouring. An overhead beam moves the forms which, with the hydraulic traveler, comprise a self-contained unit. The small crew needed for the system can pour 100 linear feet of concrete every two days, using the alternate days to strip, move and place the forms. The hydraulic system of the traveler is utilized for stripping and setting the form panels. The advantages realized from this system included the efficient and rapid movement of the forms, an excellent concrete finish, and a single clean-up which would be possible by using separate systems for floor and sidewalk sections. (Collins-FIRL)
W77-07879

MOVEMENT JOINT FOR CONCRETE SEWER BRIDGE.

New Zealand Engineering, Vol 31, No 15, p 261, November 15, 1976. 1 fig.

Field 8—ENGINEERING WORKS

Group 8F—Concrete

Descriptors: *Sewerage, *Bridges, *Concrete, *Construction joints, Bridge design, Construction materials, Prestressed concrete, Sealants, Corrosion, Engineering structures, Design criteria.
Identifiers: Hamilton City (New Zealand).

Hamilton City, New Zealand, has built a concrete bridge for transporting sewage across a river for treatment. The prestressed concrete bridge has two 1.34 square meter ducts, is 165 meters between abutments, and 15 meters above river level. Flexible duct pins provide longitudinal earthquake protection. A leak-proof, elastic jointing system (Transflex Type 200A) was used for earthquake deflection, temperature movement, shrinkage, and creep shortening. The seal also resists the chemicals in raw sewage and hydraulic pressures. (Collins-FIRL)
W77-07885

PREFABRICATED PANELS FOR SUB-SURFACE SEWAGE EFFLUENT AND WASTE WATER DISPOSAL.

For primary bibliographic entry see Field 5E.
W77-08091

8G. Materials

NWWA GROUND WATER HEAT PUMP RESEARCH IMPERATIVES.

For primary bibliographic entry see Field 8C.
W77-07692

RESEARCH FOUNDATION UTILIZES GROUND WATER HEAT PUMPS,

National Water Well Association, Worthington, Ohio.
For primary bibliographic entry see Field 8C.
W77-07693

OPEN-HOLE POROSITY LOGS CAN BE USED IN Cased HOLES.

Dresser Atlas Co., Houston, Tex.
W. H. Fertl, and P. A. Wichmann.
Oil and Gas Journal, Vol. 75, No. 14, p 84-86, April 4, 1977. 5 fig, 1 ref.

Descriptors: *Logging (Recording), *Radioactive well logging, *Porosity, Well casings, Petrography, Borehole geophysics, Oil wells.
Identifiers: Acoustic well logging, Densilog, Neutron well logging.

Standard open-hole logging devices can be used successfully for porosity determinations behind pipe, provided that the proper borehole environment, such as good cement bond, absence of severe washouts, etc., is present in the well under consideration. For situations such as the recompletion or redevelopment of old wells for which original open hole logs are unavailable, cased hole logs can be an accurate and invaluable information source. Acoustic logging for cement bond testing has been used for many years, and when good bonding is present, adequate readings for the lithology and porosity of the formation may be obtained. A combination logging system consisting of the simultaneously run scattered gamma ray density curve (compensated Densilog) and compensated neutron curve is being successfully used worldwide in open hole situations, and recent cased applications have proved quite successful as well; plots of open hole and cased hole conditions in the same well show close agreement for both the Densilog and the compensated neutron techniques. (Eberle-NWWA)
W77-07698

A VALLEY CROSSING IN PLEISTOCENE DEPOSITS,

Saskatchewan Univ. Saskatoon. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8E.

W77-07778

MECHANICAL AND HYDRAULIC PROPERTIES OF ROCKS RELATED TO INDUCED SEISMICITY.

California Univ., Berkeley. Lawrence Berkeley Lab.; and California Univ., Berkeley. Dept. of Civil Engineering.

For primary bibliographic entry see Field 8E.
W77-07779

CONCRETE-POLYMER MATERIALS—FINAL REPORT (USBR-BNL-AEC-OSW COOPERATIVE PROGRAM).

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

For primary bibliographic entry see Field 8F.
W77-07803

ELECTRONIC ISOLATION SIMULATOR FOR HYDRAULIC TURBINE GOVERNOR ALINEMENT.

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

For primary bibliographic entry see Field 8C.
W77-07804

INCREASING SEWER CAPACITY BY POLYMER DOSING.

Bristol Univ., (England). Dept. of Civil Engineering.
R. H. J. Sellin.

Proceedings of the Institution of Civil Engineers, Part 2, Vol 63, p 49-67, March, 1977. 9 fig, 3 tab, 10 ref.

Descriptors: *Polymers, *Sewers, *Flow, Performance, Costs, Chemical treatment, Chemical reactions, Sewage treatment, Economics, Waste water treatment.

An evaluation was conducted to determine the various factors involved in using polymer dosing to increase sewer flow discharge capacities. An increase of about 25% could be expected with 20-50 ppm polymer additions by weight. An increase of 140% was obtained in a 150 millimeter, 30 meters long pipe with a dose of 300 ppm. No pollution or toxicity problems occurred, except in the immediate area of an accidental bulk spill, which would be naturally cleared in a short time. Comparisons with sewer construction costs indicated that polymer injection would be a cheaper alternative. There was a clear financial advantage in most cases. A minimum sewer length is necessary to make polymer addition economically viable. Other advantages of polymer treatment include its ease of use and transport in emergency situations and its ability to prolong the life of sewer systems prone to overloads during the planning and construction of new sewers. Drag reduction in large or rough pipes will be determined by future testing. (Collins-FIRL)
W77-07883

STUDY OF IN-SERVICE BITUMINIZED FIBER SEWER PIPE.

University of South Florida, Tampa. Dept. of Structures, Materials, Fluids.

T. E. Brumagin, J. A. Colwell, and W. H. Skelton, Jr.
Transportation Engineering Journal of ASCE, Vol 103, No TE2, p 257-267, March, 1977. 10 fig, 2 tab, 2 ref.

Descriptors: *Sewers, *Pipes, Physical properties, Evaluation, Conveyance structures, Chemical reactions, Waste water treatment, Equipment, Conduits, Engineering structures.

Identifiers: Tampa (FL), Bitumized fiber sewer pipe.

Used bitumized fiber sewer pipes were recovered and tested to determine in-service changes which had occurred. Pipes used in the City of Tampa and Hillsborough County, Florida, were studied. Pipe strength had rapidly decreased according to time in service and the amount of water absorbed. Rotary knife cleaning, surface blisters, and root penetration also decreased pipe strength. Beam strength test results indicated that rigidity was less than one-third that of the original specifications. Wet conditions produced greater strength deterioration than dry conditions. This pipe was considered inappropriate for the Tampa or Hillsborough areas because of the rapid loss of needed pipe properties. (Collins-FIRL)
W77-07884

HANDLING SMALL AMOUNTS OF CRUDE SEWAGE.

Water and Waste Treatment, Vol 20, No 2, p 41, February, 1977.

Descriptors: *Sewers, Equipment, *Sewage treatment, *Sewage disposal, Pumps, Automatic controls, Maintenance, Design, Performance, Waste water treatment.

Identifiers: Middle East.

An English company has marketed specialized sewage handling equipment in the Middle East. Most applications involve sewage pumping and sewage disposal. Equipment is constructed to handle flows up to 115 liters/second, especially in cases where low and constant delivery rates are necessary. Gravity filled sewage ejectors are provided, as are fully automatic sewage pumping systems. These systems are designed to handle small crude sewage flows. (Collins-FIRL)
W77-07886

PIPES FOR SEWERAGE AND SURFACE WATER.

Pipes and Pipelines International, Vol 22, No 1, p 39, February, 1977.

Descriptors: *Pipes, Sewage treatment, Physical properties, Sanitary engineering, Mechanical engineering, Treatment facilities, Waste water treatment, Conduits, Cities, Surface water, Industrial wastes, Mine wastes.

Piping for an English scheme to improve sewerage and surface water facilities was described. The purpose was to accommodate new development and avoid sewer and drain damage by mine wastes. The village of Riccall is very near a coal field and mine wastes must be sewerage to a treatment facility which replaced the older municipal plant. The work involved a sewage pumping main and the laying of 710 meters of 200 millimeter diameter pipe and 1,985 meters of 225 millimeter diameter pipe. The pipes, constructed with Widnes joints, were laid on a granular bed with normal cover. Pipes were laid at a depth of 3 meters in the section crossing under an aqueduct. (Collins-FIRL)
W77-07887

THE CONCEPTION, DESIGN, AND CONSTRUCTION OF METROPOLITAN TORONTO MID-TORONTO SEWER.

Maclaren (James F.) Ltd., Willowdale (Ontario).
For primary bibliographic entry see Field 8B.
W77-07888

PLASTIC SEWER PIPE MATERIALS.

American Society of Civil Engineers, New York. Committee on Water Pollution Management. Journal of the Environmental Engineering Division, ASCE, Vol. 103, No. EE2, p 177-180, April, 1977.

Descriptors: *Plastic pipes, *Construction materials, *Sewers, Physical properties, Pipes, Plastics, Temperature, Flow, Corrosion control, Structural engineering.

Identifiers: Acrylonitrile-Butadiene-Styrene, *Fiberglass reinforced plastic, Polyvinyl chloride.

Recent information on plastic sewer pipe materials was presented. The two types of plastics are thermosetting, which is irrevocably set into shape once molded, and thermoplastic, which may be reheated, refabricated, and reshaped. The following pipe materials are most commonly used. Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe is used for gravity, nonpressure sanitary, and storm and drainage installations. This is available as composite pipe (Plastic shell plus filler), and as solid plastic wall pipe. The advantages of these pipes are their light weight, long laying lengths, reduced infiltration and exfiltrations, corrosion resistance, higher flow characteristics, and lower installation costs. They are, however, susceptible to ultra-violet rays which affect shape and impact strength, and they are available only in limited sizes. Continuous lateral support is necessary for structural stability. Fiberglass reinforced plastic (FRP) pipe can be used for both gravity and pressure sanitary, and storm and drainage installations. This is a Reinforced Thermosetting Resin Pipe (RTRP); various reinforcements include glass-fibers and asbestos. The thermosetting resins used are epoxy, polyester, and phenolics. Fillers, such as sand, are used in some pipes to improve stiffness and abrasion properties, but they are available for gravity service only. The FRP pipe provides high strength at a light weight, corrosion resistance, and the ability to make field connections. Polyethylene pipe has a high density and is suitable for many applications. Its life expectancy depends upon time, temperature, pressure, and wall thickness. Polyvinyl chloride (PCV) pipes are used for both gravity sewer and pressure pipe applications. It has a light weight, long laying lengths and low fraction resistance. It requires special bedding, softens at 140+ F, and is sensitive to some solvents. Specifications were listed for all the above pipe types. (Collins-FIRL) W77-07931

STRUCTURAL POLYMER, ADIPRENE REPLACES IRON PIPE FITTINGS ON NEW LIGHTWEIGHT AERATION ASSEMBLY. Elastomers Notebook, No 194, p 540, February, 1977.

Descriptors: *Piping, *Plastics, *Polymers, Chemical properties, Physical properties, Aeration, Corrosion prevention, Construction materials, Equipment, Waste water treatment, Activated sludge, Rubber.
Identifiers: Polyurethane, Reinforced fiberglass.

Piping of reinforced fiberglass joined by glass-filled polyurethane fittings have been developed for use with the activated sludge aerator. Metal piping and fittings required corrosion protection and were heavy to support and manipulate. Adiprene urethane rubber by DuPont forms fittings which adhesively bond to fiberglass downpipes and diffusion headers. The smoother wall surfaces and larger internal diameter are added advantages, providing lower head loss and power costs at any given rate of air flow. Other features of this material are long-term water resistance, physical strength, chemical inertness, and abrasion resistance which allow urethane pipe fittings to complement fiberglass piping. (Collins-FIRL) W77-07935

81. Fisheries Engineering

PASSING FISH THROUGH HYDRAULIC TURBINES. Army Engineer District, Walla Walla, Wash. F. K. Cramer, and R. C. Olliger. Transactions of The American Fisheries Society, Vol. 93(3), 1964, p. 243-250, 7 tab., 16 fig., 6 ref.

Descriptors: *Fish migrations, *Anadromous fish, *Hydroelectric plants, Dams, Dam sites, Salmon, *Fish passage, *Mortality, On-site investigations, *Turbines, Turbine blades, *Hydraulic turbines, Tailwater, Efficiencies.
Identifiers: *Kaplan turbines, *Francis turbines, *Turbine operating conditions, *Shasta Dam.

The U.S. Army Corps of Engineers has conducted extensive tests on downstream passage of fish through hydraulic turbines, utilizing both model and prototype installations. Purposes of the tests were (1) to establish design criteria for high-head Francis-type turbines that will provide optimum fish passage, and (2) to establish the best method for operating existing Kaplan- and Francis-type turbines that will provide maximum survival of fish under prevailing conditions. Tests at Allis-Chalmers' Hydraulic Laboratory, York, Pennsylvania, using 12-inch-diameter model turbines, demonstrated that mortality among fish passing through a model was of appropriate magnitude to allow comparative studies of mortality in various model installation, that mortality was greatly influenced by turbine operating conditions (efficiency) and relationship of tailwater-elevation to runner setting, and that increased clearances in the water passageways reduced mortality if turbine efficiency could be maintained. Prototype tests at Cushman No. 2 hydroelectric plant, Skokomish River, Washington, and Shasta hydroelectric plant of Sacramento River, California, verified model findings, with survival rates ranging from 45 to 77 percent at Cushman and reaching 91 percent in some instances at Shasta, depending upon turbine operating conditions and tailwater levels. (Katz) W77-07713

DISSOLVED GAS DATA REPORT, 1975-1976. Army Engineer District, Portland, Oreg. North Pacific Div. For primary bibliographic entry see Field 5A. W77-07718

MOBILE FISH CAGE AND DEPTH DISTRIBUTION STUDIES, COLUMBIA AND SNAKE RIVERS. Seattle Marine Labs., Seattle, Wash. For primary bibliographic entry see Field 5C. W77-07723

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

MERCURY IN WATER, A BIBLIOGRAPHY, VOLUME 3. Office of Water Research and Technology. Washington, D. C. For primary bibliographic entry see Field 5A. W77-07605

GLOSSARY OF WATER RESOURCE TERMS. Open Lands Project, Chicago, Ill. O. A. Titelbaum. Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 156. Price codes: A03 in paper copy, A01 in microfiche. Federal Water Pollution Control Administration, Chicago, Illinois, April 1970. 39 p, 12 ref.

Descriptors: *Thesauri, Indexing, Documentation, *Water resources, Classification, *Water pollution control, Water pollution.
Identifiers: *Glossaries, *Terminology.

The rapidly developing field of water pollution control already has stimulated its own special language through origination of new terminology and

polarization of other vocabulary formerly reserved for highly technical study. Understanding of this language is necessary for all those wishing to participate both in scientific inquiries and social action designed to solve the world-wide crisis of water pollution today. To help meet this need, the Federal Water Pollution Control Administration of the United States Department of the Interior, in cooperation with the Open Lands Project of Chicago, Illinois, a private conservation and environmental planning organization, has published this glossary of water pollution control terminology. (FWPCA) W77-07613

GAS DISEASE IN FISHES - A REVIEW. Toronto Univ. (Ontario), Dept. of Zoology. For primary bibliographic entry see Field 5C. W77-07727

ENZYME KINETICS-A REVIEW WITH EMPHASIS ON INHIBITION OF ENZYMES. Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. For primary bibliographic entry see Field 05B. W77-07732

TOXICITY TO AQUATIC ORGANISM AND CHEMISTRY OF NINE SELECTED WATER-BORNE POLLUTANTS FROM MUNITIONS MANUFACTURE- A LITERATURE EVALUATION. Army Medical Bioengineering Research and Development Lab. Fort Detrick, Md. For primary bibliographic entry see Field 05C. W77-07821

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W77-07926	5D	W77-08005	6G	W77-08084	7B
W77-07927	5D	W77-08006	6G	W77-08085	6C
W77-07928	5A	W77-08007	6B	W77-08086	4B
W77-07929	5B	W77-08008	5G	W77-08087	5D
W77-07930	5D	W77-08009	8A	W77-08088	5G
W77-07931	8G	W77-08010	7B	W77-08089	5
W77-07932	5G	W77-08011	5G	W77-08090	5D
W77-07933	5D	W77-08012	5G	W77-08091	5E
W77-07934	5D	W77-08013	5D	W77-08092	5D
W77-07935	8G	W77-08014	5G	W77-08093	4D
W77-07936	5D	W77-08015	5G	W77-08094	5D
W77-07937	5D	W77-08016	5A	W77-08095	5D
W77-07938	5G	W77-08017	3F	W77-08096	5D
W77-07939	5G	W77-08018	3F	W77-08097	5D
W77-07940	5D	W77-08019	3F	W77-08098	5E
W77-07941	5D	W77-08020	5D	W77-08099	5D
W77-07942	5D	W77-08021	5D	W77-08100	5D
W77-07943	5D	W77-08022	8C		
W77-07944	5D	W77-08023	8C		
W77-07945	2A	W77-08024	7B		
W77-07946	5G	W77-08025	3F		
W77-07947	5G	W77-08026	8C		
W77-07948	5E	W77-08027	5G		
W77-07949	5G	W77-08028	5B		
W77-07950	5A	W77-08029	5G		
W77-07951	5G	W77-08030	5D		
W77-07952	5D	W77-08031	5D		
W77-07953	5D	W77-08032	8C		
W77-07954	5D	W77-08033	4A		
W77-07955	5B	W77-08034	6G		
W77-07956	1A	W77-08035	5B		
W77-07957	1A	W77-08036	5D		
W77-07958	1A	W77-08037	5D		
W77-07959	1A	W77-08038	3F		
W77-07960	1A	W77-08039	6C		
W77-07961	1A	W77-08040	8C		
W77-07962	5C	W77-08041	6G		
W77-07963	5C	W77-08042	6G		
W77-07964	4A	W77-08043	5C		
W77-07965	5C	W77-08044	5C		
W77-07966	5A	W77-08045	5G		
W77-07967	5C	W77-08046	6A		
W77-07968	5C	W77-08047	4A		
W77-07969	5C	W77-08048	4A		
W77-07970	1A	W77-08049	6A		
W77-07971	5B	W77-08050	6A		
W77-07972	5C	W77-08051	2C		
W77-07973	5C	W77-08052	2C		
W77-07974	5C	W77-08053	2C		
W77-07975	5C	W77-08054	2C		
W77-07976	5C	W77-08055	2C		
W77-07977	5C	W77-08056	2C		
W77-07978	5C	W77-08057	2L		
W77-07979	5C	W77-08058	2L		
W77-07980	2J	W77-08059	2G		
W77-07981	2J	W77-08060	5A		
W77-07982	5B	W77-08061	2B		
W77-07983	5C	W77-08062	7B		
W77-07984	2H	W77-08063	7B		
W77-07985	5C	W77-08064	7B		
W77-07986	5C	W77-08065	7B		
W77-07987	5C	W77-08066	7B		
W77-07988	5C	W77-08067	7B		
W77-07989	5C	W77-08068	7B		
W77-07990	5C	W77-08069	7B		
W77-07991	5C	W77-08070	7B		

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Cornell University, Policy Models for Water Resources Systems	W77-07681--07685 07687, 07689 08033--08042 08045--08050	23
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W77-07853--07857 07861--07949 07951--07955 08085--08088 08090--08100	114
Illinois State Water Survey, Hydrology	W77-07646--07680 07758--07791 08051--08084	103
National Water Well Association, Water Well Construction Technology	W77-07690--07699 07701--07704	14
University of North Carolina, Metropolitan Water Resources Planning and Management	W77-07617--07645	29
University of Wisconsin, Eutrophication	W77-07962--07965 07967--07970 07972--07981 07983--08002	38
University of Wisconsin, Water Resources Economics	W77-08003--08008	6
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W77-07606--07608 07705 07793--07798 07809--07817 07849--07852	23
C. OTHER		31
BioSciences Information Service	W77-07686, 07688 07700, 07728 07730, 07735 07746	25

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SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
BioSciences Information Service	07754--07755 07799, 07801 07858--07860 07950, 07966 07971, 07982 08014, 08016 08028--08029 08043--08044 08089	
Bureau of Reclamation	W77-07803--07806	4
Environmental Information Services, Inc. (Gas Bubble Disease)	W77-07706--07727 07729	23
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W77-07818--07829 07831--07848	30
Environment Canada (WATDOC)	W77-07614--07616 07731--07734	7
National Oceanic and Atmospheric Administration	W77-07807--07808 07830 07956--07961	9
Ocean Engineering Information Service (Patents)	W77-08009--08013 08015 08017--08027 08030--08032	20
Ocean Engineering Information Service (Outer Continental Shelf)	W77-07736--07745 07747--07753 07756--07757 07800, 07802	21
Office of Water Research and Technology	W77-07601--07605 07792	6
U. S. Geological Survey	W77-07609--07612	4

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